Master Thesis

Risk attitude of Livestock Farmers

Explaining farmer's willingness to take risk

Rabobank
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Abstract

This thesis investigates farmer's visions about risk: what do they identify as potential risks and what influences farmer's willingness to take risk? Quite some time has been spent by several authors to understand willingness to take risk (risk attitude) and how it is influenced.

As entrepreneurship is almost a synonym for taking risk, several authors investigated the risk attitude of entrepreneurs and the influence of socio economic characteristics on this risk attitude. It was often suggested that several individual characteristics as age or education, and several business characteristics as for instance solvency or income, determine whether an entrepreneur likes to take risk. Entrepreneurs in livestock farming are confronted with some specific circumstances that increase the risks they face. Some authors focused on the risk attitude of (livestock)farmers. What are the risks farmers are worried about and how are farmers risk attitudes influenced by farms circumstances? This information helps us to better understand farmers and the choices they make. Recent research is however not available and farming circumstances changed fast recent years. This change probably has influenced farmer's ideas about risk.

Out of a literature review and discussions within the Food & Agri department of the Rabobank Centraal Twente a new research model was created to test the influence of socio economic characteristics on livestock farmers risk attitude. A survey was held amongst 335 livestock farmers in which respondents were asked to 1) make clear which risks they experienced as threatening 2) indicate their willingness to take risk and 3) their socio economic characteristics.

Descriptive statistics made clear which risks farmers identified as most threatening. Correlation and regression analyses were done to identify relations between farmer's socio economic characteristics and farmers risk attitude.

What farmers identify as risk looks to have changed. Farmers in this survey mentioned other risks as most threatening to their business than farmers in surveys about a decade ago. High input prices were mentioned most often as a possible threat to the business. This differs from the results of existing research on Dutch livestock farmers, in which epidemic diseases were identified as most severe risk. Despite the changes in farming circumstances the results about explaining risk attitude were in line with the conclusions of existing literature. Some socio economic characteristics are related to farmers risk attitude. Higher educated farmers, farmers with a successor, larger farms and farms with higher total income seem to be more willing to take risk. However, the regression models that have been tested explain only about 20 - 30% of the variation in risk attitude. This implies that other factors

explain móre of the variation in farmers risk attitude. As noted in former studies it is suggested again that a large part of farmer's risk attitude is explained by personal motivations, characteristics or experiences.

Preface and acknowledgements

This master thesis is written to finalize my study Business Administration at the University of Twente, specialization financial management. The paper is written externally at the Food & Agri department of the Rabobank Centraal Twente. A consequence of my agricultural background is my interest in all kind of topics related to farm management. This master thesis was a great opportunity to combine this interest with my study.

First, I would like to thank my supervisors at the University of Twente, Dr. Xiahong Huang and Prof. Dr. Rezaul Kabir for their time and tips. Their help and instructions gave me the insights I needed to write this thesis.

Furthermore I would like to thank everyone, and especially Rene Steentjes, from the agricultural relation department from the Rabobank Centraal Twente for their help: it was a very nice and interesting time for me in which I, besides writing the thesis, was able to take a little look in a commercial banking organization.

"The person who risks nothing, does nothing, has nothing, is nothing, and becomes nothing"

Leo F. Buscaglia 1924 - 1998

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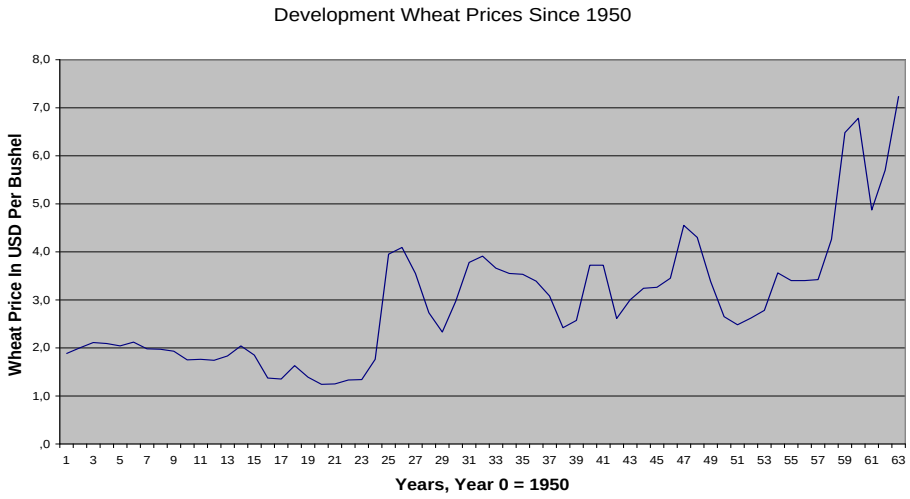
1 Introduction and context

1.1 The thesis context

As is the case in many industries, developments in the agricultural sector follow up faster and faster, especially for livestock farmers. Many developments have an impact on individual farms. Costs for inputs and revenue for sales fluctuate more and more which creates uncertainty about future income levels. Second, farming is a hot topic of debate. Consumers became more worried about the production methods used in livestock farming. Farming's impact on the environment, the extensive use of antibiotics and the lack of attention for animal welfare has led to more regulations introduced by governments. These regulations often lead to extra costs for farmers which increased pressure on their already small profit margins. Furthermore the worldwide economic slowdown has a negative impact on consumers spending power and therefore demand on agricultural products.

Figure 1. Development wheat prices (http://www.ers.usda.gov, 2012)



A good example of changing circumstances in farming is the pig industry. Pig farmers suffer from high production costs (See Appendix A for rentability Lean Hogs 2006-2010) and intensive global competition. Feed prices are record high over long periods which lead to declining gross margins. Figure 1 shows the development of wheat prices, one of the most important components of animal feed. Furthermore government regulations force some businesses to invest in animal welfare improvement and reduction of the negative impact on the local environment (ammonia): group housing for pregnant sows became mandatory and also the emission of ammonia must be reduced.

The changing circumstances have direct impact on farmer's situations. The amount of uncertainty and risks increases. How perceive farmers these risks? And how are these attitudes developed?

1.2 Rabobank

The Rabobank is a Dutch cooperative bank supplying a broad range of financial services to private individuals and companies. In the Netherlands there are 139 local Rabobanks who all have their own organizational responsibility. The Rabobank does not have shareholders; clients can become members of these local Rabobanks in order to have influence on the policy decisions of the local banks. This cooperative structure has a consequence the Rabobank does not necessarily have to strive for profit maximization in order to fulfill the wishes of shareholders. The 139 local Rabobanks together are members and shareholders of Rabobank Nederland. The primary task of Rabobank Nederland is the supportive and advising role for the local Rabobanks (Rabobank.nl, 2012).

Because of the history of the Rabobank (it is formed out of the former '*boerenleenbank'*, farmers loan bank) the Rabobank has a large market share in financing agricultural businesses, also in livestock farms. Rabobank Netherlands has a market share of 83% in financing pig farms, 80% in financing poultry farms and 87% in financing dairy farms. The total outstanding amount of loans in the primary agricultural sector was €60 billion in 2012. This is 20% of the Rabobank's total outstanding loans (Rabobank.nl, 2012).

This thesis is written for one of the 139 local Dutch Rabobanks, Rabobank Centraal Twente. Rabobank Centraal Twente consists of 6 establishments with its head office in Hengelo (OV)[1]. The Rabobank Centraal Twente employs 219 people and has a total of outstanding loans of €2.5 billion in 2011. This thesis was written on the agricultural business relations department. The Rabobank Centraal Twente also has a large market share in financing farmers in their working area (Neede, Haaksbergen, Hengevelde, Goor, Delden, Hengelo, Deurningen, Borne, Saasveld). The client file is very diverse and consists of approximately 600 farmers: small and large, active and less active.

The department consists of three account managers responsible for selling financing products to farmers. On the same department there are two insurance people who close insurance contracts (risk reduction) with farmers. This makes immediately clear that the work of the Rabobank and their clients is interconnected to risks.

[1] Hengelo (OV), stands for Hengelo in the province of Overijssel

1.3 Contribution

This paragraph makes clear how this thesis contributes to the literature and the requests of the Rabobank.

1.3.1 Contribution literature

Risk attitude has been investigated in the past, in a more general sense but also specifically the attitudes of farmers. However, the risk attitude of livestock farmers in the Netherlands was investigated most recently in 2001. As stated earlier in this chapter circumstances changed and uncertainty has increased. Therefore, farmers risk experiences may have changed.

1.3.2 Contribution Rabobank

The modern 'banker' is different from the 'financer' a few decades ago. Clients expect more from their banker. Their account manager should think about strategic issues, the ways their organization should choose into the future. The next is stated on the Rabobank website (2012): "*our clients demand more from our bank than only the lowest price. Market research made clear that our clients want to be advised about developments in their sector by an expert".* This demands more from the modern banker as they should know the business and markets their clients operate in. Especially in difficult circumstances, support from the account manager of their bank is expected. Last years, circumstances for especially livestock farmers are changing faster and faster. Prices of raw materials are record high and volatile (animal feed), farms grow fast and governments introduce new regulations. All these developments increase the (financial) risks livestock farmers face. Livestock farmers expect from their financers to have a clear view of their future and their business. To gain a better understanding of how the Rabobank clients experience these developments new research on the subject is essential. Besides that it can also give more understanding of the choices farmers make.

Concluding, this thesis tries to develop more knowledge about the following:

- what farmers experience as potential risks
- how farmers experience risk taking (risk attitude)
- how these experiences are influenced by farm and individual characteristics

The goal is to gain more knowledge about the clients. Knowledge that probably could be used by the Rabobank account managers in providing the service clients expect from their bank.

1.4 Research question

The following research questions are formulated:

- *What are the risks farmers face?*
- *How is taking risk experienced by farmers (risk attitude)?*
- *Is there a relation between socio economic variables and risk attitude?*

Main research question: is risk attitude influenced by farm's socio economic characteristics?

1.5 Outline

Now the subject of this thesis is introduced, placed in the context of today's changing farming circumstances and a research question is formulated the next step is to create a theoretical framework. In chapter three the research methods are described. It explains how data is collected and which methods are used for the data analysis. In chapter four the survey data are statistically analyzed and in chapter five conclusions and recommendations will be made based upon the statistical tests results from chapter four.

2 Literature Review

Existing literature is reviewed to create a theoretical framework about the subject. Paragraph 2.1 introduces general definitions of risk. In the following paragraphs more is told about risk in farming, risk management in farming and about the subject of the thesis: the relation between socio economic farm(er) characteristics and risk attitude of farmers. Based on the information from the literature review a research model is constructed.

2.1 Definition Risk

Despite the fact that an enormous amount is written in the literature about risk there is still no consensus about the exact definition of risk. However, most authors agree that it has to do something with uncertainty and its consequences. According Hillson and Murray Webster (2007) the simplest definition of risk is '*uncertainty that matters'*. This definition makes clear that uncertainty does not have to be a risk. Uncertainty becomes a risk at the moment it could possibly influence outcomes or objectives. Therefore the more complete definition they use is the following: '*uncertainty that could affect one or more objectives.'* This definition illustrates a new trend in defining risk. The authors talk about uncertainty 'that could affect' and not about 'uncertainty that could negatively affect'. This suggests that risks can also influence outcomes in a positive way and that some risks can also be seen as opportunity's that should be recognized so that the impact of positive risks can be maximized. However in this paper the focus is on risks that could negatively impact farmer's (financial) situation. Therefore we will use an 'old' definition of risk in this book: *'uncertainty that could negatively affect one or more objectives.'*

Another definition that fits in the context of the paper is the one of Chapman and Cooper (1983): '*the exposure to the possibility of economic or financial loss or gains, physical damage or injury or delay as a consequence of the uncertainty associated with pursuing a course of action'*.

Now we defined 'risk' we will make more clear what can be seen as risks in farming, and shortly discuss existing strategies to reduce risks.

2.2 Risk in farming

A lot has been written of risks that could threaten farmers. Risk in farming is certainly not only something of modern times. Farmers always have faced quite significant risks in their daily operations. Stead (2004) investigated risk (management) in English farming during the eighteenth and nineteenth

century. The research made clear that uncertainty affected input and output factors of farmers. Sharply fluctuating input prices of products as cake, seeds and nitrate caused uncertainty regarding the cost price of the output. Also the costs of harvesting were strongly influenced by weather circumstances. Furthermore, it was uncertain how the output would be priced. These kinds of topics are still actual for farmers today. A good description of the reason why farmers often face higher price and production risks as other manufacturers is given by Moschini and Hemnessy (2000). They state that production and price uncertainty are the most important risk for farmers. '*In agriculture the amount and quality of the output that will result from a given bundle of inputs are typically not known with certainty. This uncertainty is due to the fact that uncontrollable elements, such as weather, play a fundamental role in agricultural production. The effects of these uncontrollable factors are heightened by the fact that time itself plays a particularly important role in agricultural production, because long production lags are dictated by the biological processes that underlie the production of crops and the growth of animals.'.* Furthermore price issues play a role. '*Because of the biological production lags mentioned above, production decisions have to be made far in advance of realizing the final product, so that the market price for the output is typically not known at the time these decisions have to be made.'* (Moschini and Hemnessy, 2000)

Research by the Deutsche Bank (2010), who asked farmers about the risks they face, also showed that price/market and production risks where the ones respondents cited the most. Other risks identified in this research where: regulatory risks, technological risks, financial risks and human resources risks. Regulatory risks refer to changes in agricultural policies as introduced by the government or the European Union. Changes in policies could for instance cause decreasing amount of income support or new obligations concerning animal welfare or reducing environmental impact. Technological risks are associated with the adaption of new technologies in the branch and the problems this could cause. Financial risks are the uncertainty regarding the financing structure of the business. Risks can be for instance increasing interest rates and decreasing availability of credit. Human resource risks concern the wellness and availability farm personnel (Deutsche Bank, 2010).

Meuwissen, Huirne & Hardaker (2001) asked 612 Dutch livestock farmers to identify the risks they face. The risks farmers mentioned here are more specific than the general risk terms (price, production, regulatory, technological, financial, human resource) identified by the authors above. In total 22 sources of risks were cited by the respondents. Some of the most mentioned where: low meat/milk/egg prices, epidemic animal diseases, death of farm operator, low technical results on the farm, health situation family, environmental policy, disability farm operator, family relations, animal welfare policy, consumer preferences, value of production rights, elimination government support and changes in interest rates. Most of these risks can be identified as a risk belonging to one of the six categories mentioned by the Deutsche Bank.

What farmers see as important seems to differ geographically. A research done in New Zealand by Martin (1996) revealed that farmers there ranked besides price risks, rainfall variability as the highest risk. A research under beef producers in the US made clear that farmers see drought as an important risk (Hall, Knight, Coble, Baquet & Patrick, 2003).

2.3 Risk management in farming

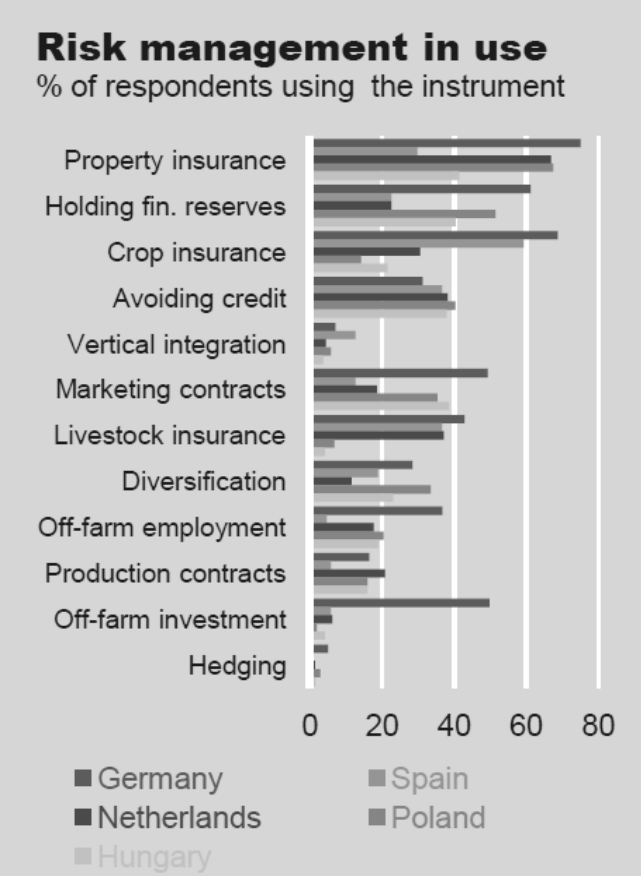
What can do farmers with the knowledge that they face many risks with respect to (the worth of) their output? Influences of many risks faced by farmers can be reduced by farmers themselves with the use of well-targeted tools. This is often in combination with other market parties as banks, insurance companies, supply chain organizations or hedge funds. If and in which degree these possibilities are used depends on the decision of the entrepreneur himself (Baltussen, 2006).

The influence of some dangers, often defined as calamities, can't be reduced adequately enough by the different free market parties. This situations can threaten the continuity of a part of the primary sector. In these circumstances there can be a role for governments. Especially when there is the need to serve the 'public good'. Falling commodity prices are negative for farmers but are a benefit for consumers. Conversely, increasing commodity prices negatively affect consumers as they need to spend a larger part of their household income to food. Relative stability is often preferred by governments. The most important categories of calamities are: infectious plant or animal diseases, extreme weather circumstances as hail or storms, international trade wars, blockades or interventions, consumer strikes or institutional risks. The reason that such risks often can't be adequately controlled by the market are that direct involvement of the government is necessary in taking care of the threat (for instance animal diseases), the size and unpredictability of the threats are so large that it can't be bared by any market party, it is very difficult to introduce new market products with sufficient participants (for instance future contracts) and some risks are not known in advance (as for instance with BSE) (Baltussen, 2006).

In the research of Flaten, Lien, Koesling, Valle & Ebbesvik (2005) 25 risk management strategies were presented to farmers. Respondents should indicate how important the several strategies were for their businesses in which they could choose for instance from the following: business insurance products, preventing from animal/crop disease, producing at lowest possible costs, the use of forward contracting, keeping cash in hands, buying of personal insurance, preventing from animal diseases, use of consultancy services, keeping assets flexible, of farm work, off farm investments, solvency management etc.. Keeping cash in hand and the purchase of business insurance products were seen by farmers as the three most important risk reducing strategies. The use of future or market contracts

(new market products) which can reduce price risks were not seen as important risk management strategies, which is in line with the results of Baltussen (2006). This is also acknowledged in the research of Meuwissen et al. (2001) and the Deutsche Bank (2010) in which the use of future contracts or market contracts don't seem to be an important risk management tool for farmers. Remarkable, as these tools can seriously reduce price risks faced by farmers. The concepts of marketing contracts and hedging will be shortly explained.

Figure 2. Risk management in use by farmers (Deutsche bank, 2010)



2.3.1 Hedging

Hedging can be used by farmers to reduce (price) risk exposure. A simple form of a hedging product that in some agricultural markets is used is that of future contracts. Future contracts are traded on financial exchange indexes. Future contracts are financial products that give farmers the opportunity to sell their future production at a fixed price and time in the future. Contrary, it is also possible to fix the price of the inputs that have to be bought in the future (Hillier, Ross, Westerfield, Jaffe & Jordan, 2010).

2.3.2 Forward contracting

Approximately10-20% of the respondents in the research of the Deutsche Bank (2010) indicated they used forward contracting as risk reducing tool. Forward contracts also give farmers the opportunity, the same as with hedging, to sell their future production at a settled price, at a settled time and a settled quantity. In contrast to hedging, marketing contracts also give the opportunity to include several other requirements as for instance quality and production methods. This can be necessary to meet the requirements of certain processors and retailers. Another big difference with hedging is that forward contracts are not closed on an exchange index but are agreements between two market parties (Melyukhina, 2011).

2.4 Risk attitude

The subject of this thesis is about risk attitude, but what is exactly meant with it and how is it described by other authors? Meuwissen et al. (2001) talk about relative risk attitude and Flaten et al. (2005) talk about comparative risk aversion. Aye and Oji (2005) just talk about risk attitude. The authors talk about the same construct but defined it different. What they describe is farmers' attitude towards risk, which means as much as farmers willingness to take risk. That author's talk about the same construct is also emphasized by the fact that the authors use similar questions in their surveys to measure relative risk attitude, comparative risk aversion and risk attitude.

Meuwissen et al. (2001) and Flaten et al. (2005) talk about farmer's willingness to take risk *compared to others*. This is done to make the construct risk attitude better definable for respondents. It is assumed that there are no farmers who 'like' taking risks (everyone is risk averse). Statements in which a respondent is asked to indicate their willingness to take risk compared to others makes it easier to define their risk attitude. This is done by Meuwissen et al. (2001) and Flaten et al. (2005). How risk attitude is measured is explained in chapter three when the operationalization of the variables is discussed.

Explaining farmer's willingness to take risk is an attempt to explain a sort of economic behaviour. Explaining economic behaviour has often been a subject of research and has led to several theories. Huirne (2003) tried specifically to explain the risk behaviour of farmers and discussed several theories.

The decision making theory states that decisions are made after a stepwise pattern was followed which made clear what the best alternative is to choose. The following steps are included in this theory: observing and defining the problem, developing and analyzing alternative solutions, making a choice among alternatives, having the decision carried out and evaluating the result of the decision. The

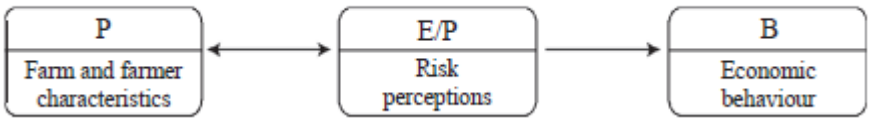
system theory sees that an individual or business is part of a larger system and it argues that decisions are influenced by the context an individual/organization operates in. In the system theory a farm would be a unique, open and dynamic system that wants to earn a certain income. Choices are influenced by this context. The last theory is the objective theory. It states that behaviors can be explained by looking at the goals an entity has. Main criticism on these theories is that decisions could also be influenced by personal and emotional factors and can't be fully explained by rational thinking, researching the context or looking at the goals of an individual/organization (Huirne, 2003). This thesis tries to explain a certain behavior by investigating the influence of some socio economic characteristics. It can therefore be stated that it is a test for the system theory, which indicates that factors in the environment of an individual or business explain economic behavior.

2.5 Determinants risk attitude and hypothesis setting

Several papers are discussed now in which the influence of several socio economic variables on risk attitude or decision making is reviewed. Selected were not only researches focused on farmers but also on individuals or businesses in general, this to create a broader view. The focus is on identifying factors mentioned in existing literature that could probably influence farmer's risk attitudes. Based on the assumptions and results from the authors hypotheses are formulated.

The topic of this thesis can be illustrated by a model of van Raaij (1981), as shown in figure 3. Van Raaij investigated the relation between farm and farmer characteristics and risk perception and as a second step the influence of risk perception on the economic behaviour of farmers. Although van Raaij (1981) talks about risk *perception* it is suggested by Flaten et al. (2005) that the construct is highly similar to risk aversion, the dependent variable described in the research of Flaten et al. (2005). As stated earlier, different authors use a bit different subscriptions but try to explain quiet the same thing. Therefore it is suggested that this overview of van Raaij (1981) also gives a good overview of this thesis subject which is about risk attitude.

Figure 3. (Van Raaij, 1981)



The relation P -> EP shows a relation between farm and farmer (individual) characteristics (P) and farmers attitudes of risk (E/P), which describes the topic this thesis is about.

It is now discussed which variables are found in existing literature that could probably influence (farmers) risk attitude.

2.5.1 Farmers individual characteristics (age, education, experience)

Age

Age is a variable included in many researches. Mischra and Goodwin (2005) suggest that younger people are more adventurous than older ones and that it is therefore likely to assume that younger persons are less risk averse than older farmers. Jing et al. (2001) also share this view based on research of Sung and Hanna (1996). Aye and Oji (2005) however acknowledged that papers in the existing literature show different results. They expect that older farmers are more willing to take risk. The controversy in expectation has probably to do with the different cultures in which the research was held.

Jing et al. (2001), Sherrick et al. (2006) and Deakin et al. (2003) found negative relations between farmers age and risk attitude. This means that farmers with a lower age are more willing to take risk than farmers with a higher age. A positive relation was found by Aye and Oji (2005). This implies that older farmers are more willing to take risk than older farmers. As the culture in the region Twente (where the survey was held) is more similar to the ones in the researches of Jing et al. (2001) and Sherrick et al. (2006) it is expected that younger farmers in this thesis are more willing to take risk. This leads to the following proposition:

H1: younger farmers are more willing to take risk than older farmers

Education

Education was another individual characteristic included in most researches. Mischra and Goodwin (2005) suggest that people with higher education are less risk averse. Higher educated people have more knowledge and skills to interpret risks in a proper way and are therefore to be assumed less risk averse. Aye and Oji (2005) see wealth of the family as a factor that is related to willingness to take risk. They suggest that higher educated people can be a hint for more wealth in the family and that therefore education is positively related to willingness to take risk. Deakin et al (2003) looked for a correlation between IQ and willingness to take risk. Although IQ reflects not exactly the same as educational level it is quite logical to think that people with higher IQ's are higher educated.

Deakin et al. (2003) found a positive correlation between IQ level and risk attitude which gives more support to the expectation that higher educated people are more willing to take risk. Meuwissen et al. (2001), Jing et al. (2001) and Aye and Oji (2005) also found that higher educated farmers are more willing to take risk: they found significant positive relations between the variable education and the variable risk attitude. This leads to our following hypothesis:

H2: high educated farmers are more willing to take risk than low educated farmers

Experience

The next variable concerns farmer's experience. Aye and Oji (2005) suggest that the more experience farmers have the less risk averse they are. Experience was also included as independent variable in the research of Flaten et al. (2001). No evidence was found in the literature. However the hypothesis will be tested in this thesis:

H3: experienced farmers are more willing to take risk as non-experienced farmers

2.5.2 Farm characteristics (solvency, total income, business size, successor, farm type, off farm income)

Solvency

Solvency has received a lot of attention in the literature. The solvency ratio measures a business amount of debt in relation to the total amount of assets. The solvency ratio says something about the risk position of financers: it makes clear if creditors (banks) can reclaim their money in case when the business quits. A negative solvency ratio implies that debts are larger than the worth of the total assets. It can happen that when there is not enough collateral to cover the debts of the bank anymore that banks claim collateral to repay the debts. It is assumed that farmers with a low solvency ratio (large amount of debt as part of total assets) are more risk averse as they are more vulnerable for financial distress. In these situations there is a higher chance that financers reclaim debts in the form of collateral which means businesses go bankrupt (Mischra and Goodwin, 2006)

A negative relation between solvency and risk attitude was found by Meuwissen et al. (2001), Mischra and Goodwin (2006) and Sherrick et al. These authors conclude that farms with a lower solvency are less willing to take risk than farmers with a high solvency. Therefore the following hypothesis is formulated:

H4: farms with a low solvency rate are less willing to take risk than farms with a high solvency rate

Farm type

This thesis is about livestock farmers, however between the different livestock branches exist: dairy, pig, poultry, goats, bulls etc.. Different branches face different circumstances which can lead to differences in risk attitudes and willingness to take risk. Dairy farmers received lot of support from governments and the European Union for many years, this in contradiction to for example pig and poultry farmers who produce for the free world market without government or European Union support. However, in coming years support for the dairy sector will be reduced and within the dairy sector there is a lot uncertainty about how the market will develop in the future. It can therefore be suggested that this has an influence on farmers risk attitude. Therefore the following hypothesis will be tested:

H5: dairy farmers are less willing to take risk than other types of farmers

Successor

The presence of a successor was also included in the research of Meuwissen et al. (2001) and Flaten et al. (2005). These authors did not mention any expectations about the relation of this variable with risk attitude. It could however be suggested that farmers who know they have a successor are willing to take more risk than farmers who know they don't have. If there is a successor there is more need to keep the farm 'up to date', meeting modern standards. Therefore the following hypothesis about the presence of a successor is formulated:

H6: farmers with a successor are willing to take more risk than farmers without a successor

Off farm income

The last variable discussed from the literature review is the presence of an external income within the farm household. It was suggested for instance by Mischra and Goodwin (2006) that external income reduces the dependency on the farm income and could make farmers more willing to take risk.

A significant positive relation between the variable off farm work/income and risk attitude was found by Flaten et al. (2001) and Mischra and Goodwin (2005). This means that farmers with a source of income outside the farm are more willing to take risk than farmers who have to trust solely on the farm income. The hypothesis concerning this variable is therefore:

H7: farmers with external income(s) are more willing to take risk than farmers without external incomes

Total Income

Household/business income is another variable included in several research models. Household income reflects the total household income of an entrepreneur. This means income earned from the business and other sources. It is suggested that farms with higher incomes are less risk averse and more willing to take risk. Higher income makes people feel more secure and increases their willingness to take risk. This was for instance suspected by Aye and Oji (2005) who indicated that poor farmers are less willing to take risk in investing in new production technologies.

A positive relationship between total/business income and risk attitude was found by Flaten et al. (2005), Meuwissen et al. (2001) and Aye and Oji (2005). This implies that farms with a higher business income are indeed more willing to take risk. The following hypothesis will be tested in this thesis:

H8: farms with high incomes are more willing to take risk than farmers with low incomes

Size

Business size was also included in many researches. Jing et al. (2001) assumed that persons with a higher number of businesses, higher gross sales and a higher number of employees often are wealthier and are therefore assumed to be more willing to take risk. It could also be suggested that larger farms have better perspectives in the future and are therefore more likely to take risk.

Farm/business size was found positive relating to risk attitude by Flaten et al. (2005), Meuwissen et al. (2001) and Jing et al. (2001). These authors agree with the hypothesis that larger farms are more willing to take risks. The hypothesis is therefore:

H9: large farms are more willing to take risk than small farms

Table 1. Literature overview.

The V sign indicates a significant relation is found. Red colored V's indicate a negative relationship, green colored V's a positive relationship. A black stripe indicates the variable was included in the research but no relation was found. Empty boxes were not included the research.

	Flaten et al.	*Meuwissen et al.*	*Mischra & Goodwin*	*Jing et al.*	*Sherrick et al.*	*Aye and Oji*	*Deakin et al.*
Solvency	--	V	V		V		
Business income	V	V				V	
Business size	V	V		V/--	--		
Presence of a successor	--	--					
Farm type		--					
Form of ownership	--	--		--			
Education	--	V		V	--	V	V
Off farm work/income	V	--	V		--		
Age	--	--		V	V	V	V
Farming experience	--			--			

Discussed are the relations between the different socio economic variables and risk attitude. Authors were however also interested in the total explanatory power of their research models. Which part of variation in risk attitude can be explained by socio economic variables?

The authors come to different findings of the explanatory power of their models. Flaten et al. (2005) and Meuwissen et al. (2001) concluded that socio economic variables explained only a small part of the variation in their dependent variables relative risk attitude and comparative risk attitude. Both authors suggested that probably other factors were more determining farmer's willingness to take risk. Jing et al. (2001) looking at the relative risk attitude of entrepreneurs in family businesses found an explanatory power of their model of 38% and stated that socio economic characteristics are definitely partly determining entrepreneurs willingness to take risk. This conclusion was also formulated by Aye and Oji (2005) who found an explanatory power of their model of around 35%.

It can be concluded that the different authors come to different conclusions and is not logical to expect a certain outcome. However, the two studies done in most similar circumstances as this thesis (Flaten et al. (2005) and Meuwissen et al. (2001)) found no relations.

2.5 Discussion team leader

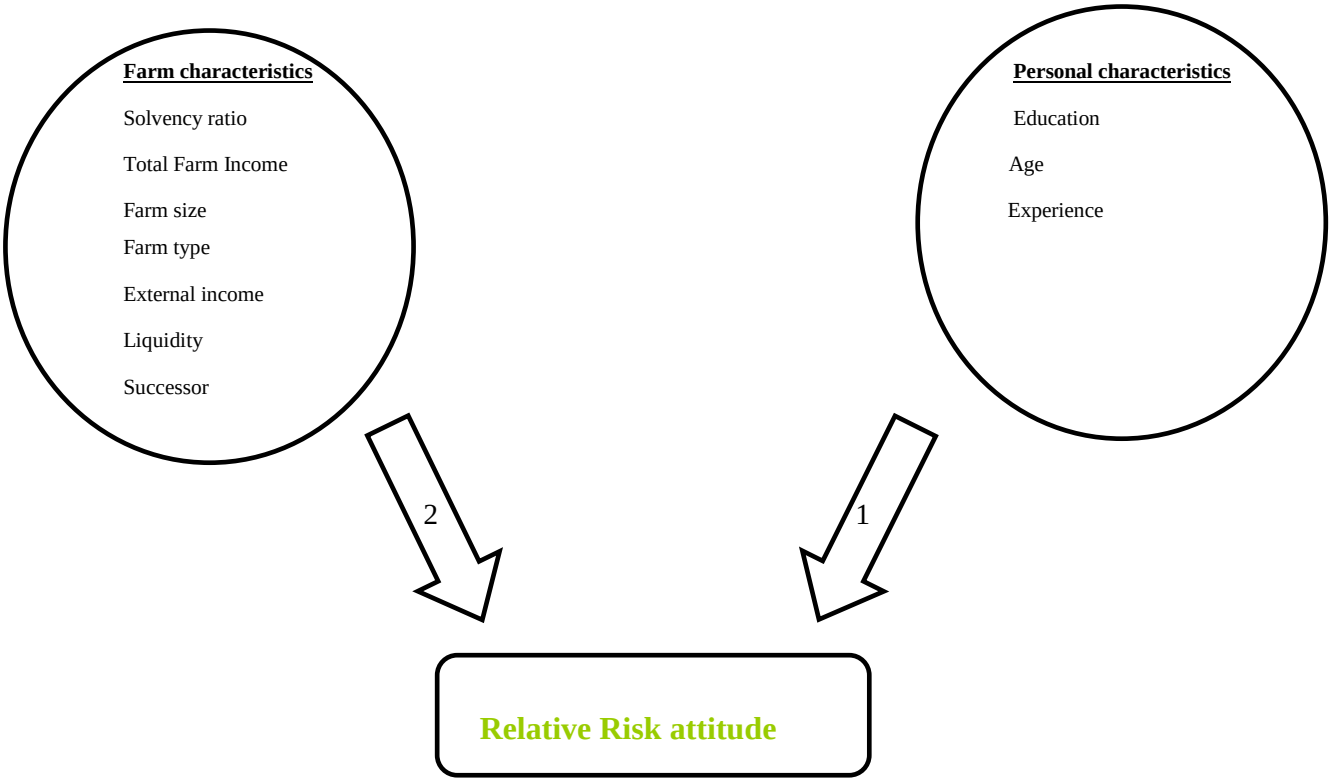
Besides the literature review several discussions took place about the subject with the team leader of the department. He has more than 20 years' experience in the field and agreed with the variables extracted from the literature to use in this thesis. In the discussion one other variable popped up that could probably influence risk attitude but was not mentioned in the literature. The variable introduced is liquidity. Last years' more liquidity problems occurred. This has probably to do with high growing speed of farms and volatile market circumstances. This makes farmers more vulnerable for short term deficits. Solvency ratio is used in most researches, liquidity not. However, the team leader says that liquidity problems can create a lot of pressures and indecent feelings within the families involved. It is therefore suggested that these farmers could be more risk averse as they don't want to take any more risk that might worsen the situation. Therefore the last hypothesis states

H:10b farms that faced liquidity problems last year are less willing to take risk than farmers who did not face liquidity problems

2.6 Research model

The model on the next page will be tested to look for a relation between farm and personal socio economic characteristics and farmers relative risk attitude. It is a new model that was set up on basis of the literature review and team leader discussions. In contrast to existing literature, this model will not only look to the relation of the complete package of socio economic characteristics on risk attitude, but also to the separate influence of farm characteristics and personal characteristics.

Figure 4. Research model



3 Research Method and Data

This chapter will explain the research and data collection methods are chosen. Statistic tests are needed to identify the relation between the independent variables and risk attitude (sub question 3). Descriptive statistics can be used to answer sub questions one and two. Different research methods (both bivariate and multivariate) were used in the existing literature. Based on this information and the characteristics of data in this thesis the research method will be chosen that can be used in this paper.

3.1 Research methods

3.1.1 Correlation analysis and T-Test

Some authors used (besides multivariate analysis) bivariate techniques to look for the relation between several independent variables and relative risk attitude or tests to identify differences in certain variables. For instance, Deakin et al. (2003) looked at the relation between age, gender, education and risk attitude. The authors in this paper used therefore correlation analysis. While their independent variables were also ordinal scaled Pearson correlation analysis was used.

Correlation analysis gives insights in a relation between two variables. The analysis makes clear in which amount two variables are related and in which direction (positive or negative). A correlation of 1 means that the variables are perfectly positive correlated, which in reality almost doesn't occur. Graphically this would represent a line with all the observations of both variables on one line. Conversely, a correlation of -1 means that two variables are perfectly negatively correlated. Graphically this would mean two lines with exactly the opposite directions. Correlation analysis is appropriate for variables that are interval or ratio scaled. For ordinal scaled variables is a similar test available, the Spearman correlation (Huizingh, 2006).

The dependent variable RRA is interval scaled. The independent variables have different scales. Some independent variables are interval or ordinal scaled. In these cases Pearson correlation analysis can give insights in the relation between the independent socio economic variables and the dependent variable, as is also done by Deakin et al. (2003). However, some variables are binary scaled and correlation analysis is not the most appropriate tool as correlation analysis requires interval or ordinal scaled variables. A more powerful test for these cases is the T-test.

Independent Sample T test

The T-test can check for significant differences on variables between two groups. Variables should be of an interval or ratio scale and normal distributed (Huizingh, 2006). The dependent variable relative risk attitude was found normally distributed (paragraph 4.4) and therefore this test can be used to test the hypotheses concerning the following variables: liquidity, successor, off farm income, farm type. To test the variables the total sample can be divide in two groups to check the differences for the relative risk attitude score on that variable. One variable for which this can be done is liquidity. Two groups can be made, one group with liquidity problems and one group without, where after a T-test can be done to look if there are significant differences on the relative risk attitude score between these groups.

Although correlation and T-test analysis give interesting information, they do not control for the influences of other variables. A multivariate regression analysis will give more statistical evidence, as it tests relations when other potential determinants are also present. Besides that, it gives an indication of the total explanatory power of the model: which amount of variation in risk attitude can be declared by the influence of socio economic variables.

3.1.2 Regression techniques

Several regression techniques were used in the existing literature. The relation between multiple socio economic characteristics and risk attitude was analyzed with binary logistic regression by Flaten et al. (2005). The goal was to find out which amount of variation in risk attitude could be explained by socio economic variables. Meuwissen et al. (2001) also analyzed data with binary logistic regression. Jing et al. (2001), who looked at the risk attitude of entrepreneurs in family businesses, and Mischra and Goodwin (2006) who researched the participation of grain farmers in insurance programs also used binary logistic regression to investigate the relation between entrepreneur's socio economic characteristics and risk attitude. The dependent variables were mostly binary which makes binary logistic regression the appropriate method. Aye and Oji (2006) used multivariate regression analysis. The dependent variable in the research of Aye and Oji (2006) is interval scaled which makes multivariate regression an appropriate statistical test to use. Both binary logistic regression and multivariate regression methods are used when testing the research models. The dependent variable in this thesis is interval scaled which makes multivariate regression a proper statistical method to use.

Multivariate regression analysis tries to estimate the effect of some independent variables that are assumed to be related to the dependent variable. In socio – economic research, multivariate regression

analysis is often preferred above a single regression model. In social sciences constructs or events can seldom be explained by only one variable. In these cases a model that looks at multiple predictors at once is more precise in estimating the relations between the dependent and independent variables (van Bavel, 2006).

Multivariate regression analysis can be done when some assumptions about the form of the data are met. One of the most important assumption concerns the level of measurement of the variables. The variables, dependent and independent should be of an interval, ratio or ordinal scale. Nominal variables can only be included as dummy variables (Huizing, 2006).

Variable measurement level is not the only point of concern when using multivariate regression analysis. Three other requirements are the linearity, normality and homoskedacity of the residuals and the absence of multicollinearity of the variables. Assumptions of linearity, normality and homoskedacity can be checked by analyzing a scatter plot. A scatter plot shows the predicted scores on one axis and on the other axis the errors of prediction. Tabachnick and Fidell (2007) state that *"the residuals (the difference between the obtained DV and the predicted DV scores) should be in a straight-line relationship with the predicted DV scores (linearity); and the variance of the residuals should be the same for all predicted scores (homoscedasticity)".* When this is the case it can be concluded that the assumptions of linearity, normality and homoskedacity are met. The absence of multicollinearity will be checked by means of a VIF test.

The following formulas represent the linear expected relations. Formula one represents the model with the individual characteristics, formula two respresents the model with the farm characteristics and formula three represent the complete research model including all the independent variables.

$$RRA: \beta 0 + \beta 1 \times Age + \beta 2 \times Education + \beta 3 \times Experience + \varepsilon it \quad (1)$$

$$RRA: \beta 0 + \beta 1 \times Solvency + \beta 2 \times Total\ income + \beta 3 \times Farm\ size + \beta 4 \times Off\ farm\ work + \beta 5 + Farm\ type + \beta 6 \times Successor + \beta 7 \times Liquidity + \varepsilon it \quad (2)$$

$$RRA: \beta 0 + \beta 1 \times Age + \beta 2 \times Education + \beta 3 \times Experience + \beta 4 \times Solvency + \beta 5 \times Total\ income + \beta 6 \times Farm\ size + \beta 7 \times Off\ farm\ work + \beta 8 \times Farm\ type + \beta 9 \times Successor\ x + \beta 10 \times Liquidity + \varepsilon it \quad (3)$$

Within these equations $\beta 0$ refers to the constant factor and the other β factors refer to the beta of that specific independent variable. *Eit* is the error term which reflects the variance in the outcome that is not explained by the included variables.

3.2 Operationalization of the variables

3.2.1 Dependent variable: relative risk attitude (RRA)

Flaten et al. (2005) determined farmer's willingness to take risk as follows. The farmers had to answer *'their willingness to take risk compared to others'* on three different categories: production, marketing and finance/investment on a 7 point Likert-scale. The answers were summed up and gave a total score that reflects farmers relative risk attitude.

Meuwissen et al. (2001) used a similar method to measure relative risk attitudes as Flaten et al. (2005). They used five statements in which farmers have to rate their willingness to take risk compared to others with respect to several categories. The statements could be ranked on a 5-point Likert-scale.

It can be concluded that the different authors who researched risk attitude (of farmers) used similar methods to determine the construct risk attitude. Because of the consensus about this in the literature a comparable method is used in this thesis to measure farmers relative risk attitude (RRA). In 3 statements farmers rank their willingness to take risk compared to others on a 7 point Likert scale as can be seen below. In first instance a 5 point Likert scale was chosen. However, in pre-testing the survey with farmers some comments were that the choice was too limited on a 5 points scale. Therefore finally a 7 point Likert scale was used. The sum of the answers regarding these statements is divided by three which gives the average score for the first three statements and which is the dependent variable relative risk attitude. A farmer with a high score on relative risk attitude has a high willingness to take risk, a farmer with a low score on relative risk attitude has a low willingness to take risk. The fourth statement was used to check for consistency of the answers. The average score of the first three answers is compared with the score on statement four. No extreme differences were found (max 2,3). This is an indication that the answers and scores on the first three statements give a good indication of farmer's willingness to take risk. Furthermore, the mean of the score on questions 1-3 (4,22) is quiet similar to the mean score on question 4 (4,1) (Appendix H). This is another indication that answers are consistent.

Table 2. Statements relative risk attitude

I am willing to take more risks than my colleagues with respect to:

1. . . . production issues	1	2	3	4	5	6	7
2. . . . marketing issues	1	2	3	4	5	6	7
3. . . . financial/strategic issues	1	2	3	4	5	6	7
4. . . . farming in general	1	2	3	4	5	6	7

3.2.2 Independent variables: age, education, farming experience, off farm work, solvency, total farm income, farm size, farm type, successor and liquidity

Age (AGE)

The age of the farmer will be measured by an open question in which the farm leader gives his age in years. The variables will therefore be interval scaled.

Education (EDU)

Education is measured as the highest level of education received by the respondent. It is a multiple choice question in which respondents can make clear what their highest schooling has been: high school, MBO, HBO, WO. While it is a multiple choice question this variables will be ordinal scaled.

Experience (EXP)

Variable measures the amount of years entrepreneurial experience of the respondent. It is an open Question and the variable will be interval scaled

Solvency Ratio (SOLV)

According Hillier et al. (2010) '*long term solvency ratios are intended to address the firm's long run ability to meet its obligations. The total debt ratio takes into account all debts of all maturities to all creditors'.* High solvent farms have more own assets and are therefore assumed to be better able to repay loans or other debts on the long term. Altough several defintons exist concerning a business's solvency the following definition is used in this thesis, called total debt ratio by Hillier et al. (2010):

Solvency ratio = total amount of debts / total assets x 100%

Farm income (F.INC)

Farm income is measured as the total net income of farm. This means that earnings from outside the farm are also included. In the survey this variable will be measured with a multiple choice question in which respondents can indicate in which income category they fall: 0-20.000, 20.001 - 40.000, 40.001 – 60.000, 60.001 – 80.000 or 80.001 +.

Farm Size (F.S)

Farm size will be measured in NGE. NGE is a Dutch measure of farm size introduced by the Wageningen University to express the economic size of a farm. It is based on the amount of animals and ground a farm possesses. The respondents are just asked to make clear how large their herds are. After that this numbers are converted to a NGE size: 1 dairy cow is 1,20 NGE, 1 pig finisher is 0,04 NGE, 1 sow is 0,2606 NGE, 1 laying henn 0,0026 NGE and 1 broiler chicken 0,0013 NGE (wageningenur.nl, 2012).

External income (E.INC)

Respondents will be asked if their household has an external income. This is a multiple choice question with two answers: no or yes.

Farm type (F.TYPE)

This variable indicates what the most important livestock activity of the farm is. It is a multiple choice question with eight options: dairy cows, laying henns, broilers, sows, fattening pigs, goats, bulls or other. This is a nominal scaled variable.

Successor (SUCC)

Makes clear the farmer has a successor or not. Indicated by a multiple choices question: no or yes. This makes the variable binary scaled.

Liquidity problems (LIQ)

Respondents indicate if they had liquidity problems last year. According to Hillier et al. (2010)

'liquidity refers to the ease and rapidity with which assets can be converted into cash… The more liquid a firm's assets, the less likely the firms is to experience problems meeting short term obligations'. In the survey liquidity problems are described as problems in meeting short term obligations. The question will be multiple choice with two possible answers: no or yes.

The next table gives an overview of all the independent variables.

Table 3. Operationalization variables

Variable	**Definition**	**Code**	**Scale**	**Interview Question (Appendix E)**
Individual Characteristics				
Age	Age in years	Open question, answered in years between 0-98	Interval	5
Education	Answers should point out highest level of education farmer has had: high school, MBO,HBO,WO.	Multiple choice: Primary '1', MBO '2', HBO '3', WO '4'.	Ordinal	7
Experience	Years of Experience in farming	Open question: Answered in years	Interval	8

Farm Characteristics

Solvency ratio	The amount of debt as part of the total assets	Multiple choice: 0%-20% '1', 21%-40% '2', 41%-60% '3', 61%-80% '4', 81%-100% '5'.	Ordinal	14
Farm income	Total income, farm income + other sources of income	Multiple choice, 0-20.000 '1', 20.001-40.000 '2', 41.001-60.000 '3', 60.001-80.000 '4' , 80.001+ '5'	Ordinal	19
Size	Farm size (NGE). Respondents give indication of livestock in stock where after farm size is expressed in NGE	Open question: answered in number of livestock type present at the farm	Interval	20
External income	Whether the family has an income from outside the business	Multiple choice: no '0', yes '1'	Binary	18
Farm type	Type of farm, what is the main activity of the farm. Made binary afterwards in line with hypothesis	Multiple choice: Dairy '0', Other '1'.	Binary	13
Successor	To reveal if there is a successor	Multiple choice: No '0', Yes '1'	Binary	16
Liquidity	To reveal if there were liquidity problems last year	Multiple choice: No '0', Yes '1'	Binary	15

3.3 Validity

Validity refers to the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration. Does the measure calculated really reflect the concept/relation you wanted to measure? Several methods can increase the probability of valid results. (Babbie, 2007). Babbie mentioned four types of validity.

3.3.1 External validity

External validity is about the degree the results are generalizable. It makes clear how the inferences may hold over a variation in persons, settings, treatment variables and measurement variables (Babbie, 2007). Discussed are now the threats that could decrease external validity and how external validity holds in this thesis research.

Some features of the research decrease the generalizability. The respondents are all from the central Twente region. We cannot deny that this may have consequences for the generalizability of the results. As for instance culture may have influence on the dependent variable the generalizability is limited in the sense of the geographic area. It is probably generalizable to livestock farmers in the eastern part of the Netherlands. Because of the focus on livestock farmers, results are not generalizable to other kinds of businesses as well. What increases the validity of the results is the fact that the proportion of the different type of livestock famers has some similarities with the Dutch proportion of the several types of livestock farmers (see also Appendix F). This is an indication that the average livestock farmer in this research has some similarities with the average Dutch livestock farmer.

3.3.2 Construct validity

Construct validity is about the inferences made on the higher order constructs that reflect the sampling particulars. This means that construct validity examines the operationalization made (Babbie, 2007).

Failure to describe all the constructs may result in incomplete construct references when respondents do not understand the survey and their constructs well. To reduce this threat to validity the survey was pretested several times to be sure the questions were clear and understandable.

Experimenters can influence participant responses by conveying expectations about desirable responses, and those expectations are part of the treatment construct as actually tested. In this research respondents are asked to give an indication of their willingness to take risks. It is thinkable that

respondents don't want to feel like a coward and rate their willingness to take risks higher as it actual is. To reduce the probability of this problem questions should be asked as neutral as possible. This is done for instance within the survey by not indicating whether taking risk is 'good' or 'bad'. Especially in this case it is important that respondents don't have the idea that not taking risk is seen as weak or incapability to run a business.

3.3.3 Internal validity

Internal validity refers to the *'validity of inferences about whether an observed covariation between A (cause) and B (effect) reflects a causal relationship from A to B as those variables were manipulated or measured'.* An inference can be hold for true if one can show that A preceded B in time, that A covaries with B and there aren't any other explanations for the relationship between A and B. (Shadish, Cook and Campbell, 2005).

In the questionnaire the *current* risk attitude is calculated. The different socio economic variables (cause) precede current risk attitude (effect) in time. Therefore it should be realistic to expect that this threat does not influence results. However an inverse relation cannot be totally ruled out: the influence of risk attitude on the independent variables. It can for instance be assumed that individuals with higher relative risk attitudes invest more and therefore have bigger farms. This is the inverse relation investigated in the thesis: farm size → relative risk attitude. In this case the there is an ambiguous temporal precedence threat. This could be subject of further research. This threat of ambiguous temporal precedence can also be not ruled out for the variables total income, liquidity problems and solvency ratio. It can't occur for the variables successor, age, education, farm type, off farm work and experience. This is because it is not likely that relative risk attitude influences the fact whether there is as successor or not, farmers age, farmers education, the type of farm a farmer owns, if there is off farm work and farmers experience. This threat can only be reduced when farmers are surveyed more often through the years. In that case it is possible to look how risk attitude and farm size fluctuate and if there is a certain direction of the relation.

Another threat to internal validity is the one of selection bias. This threat occurs when subjects of study do not have equal chances to be involved in the survey. This threat can be reduced by random sampling, in which every possible respondent has equal chances to be included in the research (Babbie, 2007). In this thesis all the respondents from the Rabobank Centraal Twente client file which had (1) an e-mail address and (2) that gave permission to be approached for mailings were invited in the survey. This means that all type of livestock farmers had equal chances to be included in this research. This increases the internal validity.

3.4.4 Statistical conclusion validity

Statistical conclusion validity is about the validity of the inferences about the correlation between A and B. Statistical conclusion validity regards to the statistical inferences made about the correlation of a causal inference. First it is about whether the cause and effect covary and second about how strongly they covary. Threats to this type of validity cause false inferences about the existence of a covariance and the size of it (Babbie, 2007). Discussed are now the threats that could decrease statistical conclusion validity and how statistical conclusion validity holds in this thesis research.

Violating test assumptions is threat for the statistical validity of the results. However, the tests are carefully chosen given the situation and nature of the variables. This is the way to minimize this threat to statistical conclusion validity. Regression analysis assumes some assumptions and these assumptions were checked and discussed in chapter four.

3.4 Data collection

Data to analyze needs to be collected. A proper way of eliciting information from respondents is a survey. Surveys may be used for descriptive, explanatory, and exploratory studies. This thesis can be identified as an explanatory research as it tries to explain a certain relationship between a dependent and multiple independent variables. Surveys can be used for other units of analysis than individuals such as groups or interactions, but individual persons must serve as respondents. *'Survey research is probably the best method available to the social researcher who is interested in collecting original data for describing a population too large to observe directly'.* A questionnaire is an instrument specifically designed to elicit information that is useful for (statistical) analysis. (Babbie, 2007)

The data will be collected from questionnaires who will be send to livestock farmers out of the Rabobank Centraal Twente clients file. This file contains about 600 livestock farmers: especially dairy farmers, pig farmers and poultry farmers. 335 clients were invited to fill in the survey. Respondents were randomly chosen from the client file. The sample contains a mix of dairy, pig, bulls, goat and poultry farmers. In total 107 respondents (partly) filled in the survey. However only 62 of the 107 respondents completed the survey and were used for statistical analysis, indicating a response rate of 19%. At first glance, it looks like a very high rate of the respondents quitted the survey. However after looking more closely to the results it became clear that the 107 partly filled surveys also contain the respondents that just opened the survey but did not answer any question. A huge part of the respondents who quitted the survey didn't answer any question at all. Furthermore, there are no signs

that respondents who only partly filled in the survey quitted at a specific question. How this research sample reflects the Dutch livestock farmers is discussed in chapter 4.

Before the survey was held it was tested within and outside the department. Two colleagues are farmers themselves (both have mixed farms, dairy cows and pigs) and were therefore good test respondents. Furthermore an appointment was arranged with a client (dairy farmer) of the Rabobank Centraal Twente. The aim was to test if the survey was clear and understandable. Several improvements were made after the tests.

4 Data analysis

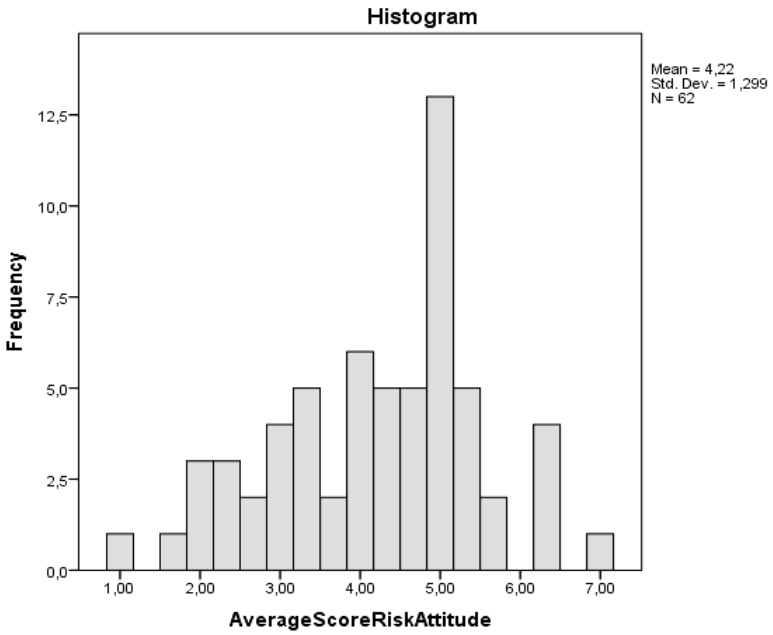
4.1 Outline

This chapter contains the results of the data analyses done with SPSS. With these results it is possible to answer the research questions. First some descriptive statistics are shown in paragraph 4.2 and 4.3. These describing results give an indication of the respondent's characteristics. After that, in paragraph 4.4 and 4.5 the more explanatory statistical tests are done to identify the role of the several socio economic variables in relation to the dependent variable risk attitude.

4.2 Descriptive statistics

The descriptive statistics in this paragraph give an overview of the respondent's answers and a summary of the information. The histogram in figure 5 graphically shows the distribution of the dependent variable risk attitude. This is the total score the given answers on statements 1 – 3, divided by three (questionnaire in Appendix E). A Kolmogorov Smirnov test was done to check normality of the dependent variable. Distribution of the dependent variable is an important aspect in choosing proper statistical tests. The Kolmogorov Smirnov test tests the null hypothesis that the variable is normal distributed. The alternative hypothesis assumes that the variable is not normal distributed (Huizingh, 2006). No evidence is found (P value of 0.242) to support the alternative hypothesis that the variable relative risk attitude is not normal distributed (see appendix G). The distribution of this variable is presented in a histogram in figure 5.

Figure 5. Scores Relative Risk Attitude



The average risk attitude score of 4,22 indicates that farmers state they would like (on average) to take slightly more risk than their colleagues. Appendix H shows the histograms for the answers on statements 1- 4 from the survey and an overview of the results found by Meuwissen et al. (2001). It can be seen that farmers are more willing to take risk on production and financial issues than on marketing issues. Farmers would like to take more risk in improving production processes and in developing the business for the long term than on marketing issues (for instance switching from suppliers are buyers). This is in line with the results of Meuwissen et al. (2001).

Table 3. Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Median
AGE	62	23	64	43.98	11.33	44
EDUC	62	1	4	2.23	0.81	2
EXP	62	0	45	20.02	12.42	20
SOLV	62	1	5	2.92	1.12	3
LIQ	62	0	1	0.31	0.46	0
SUCC	62	0	1	0.71	0.45	1
E.INC	62	0	1	0.63	0.48	1
T.INC	62	1	5	2.60	1.20	2
F.SIZE	62	20	460	131.10	86.73	105.44

The information in table 3 shows some more descriptive statistics concerning the independent variables. It shows the number of valid respondents per variable, the maximums of the respondent's data, the minimums of the respondent's data, the means of the data and the standard deviation. Respondents age varies between 23 and 64, with 44 as median and 43,98 as mean age. The average score on education is 2.23 which indicates that the average respondent falls between education category two and three, between MBO and HBO. The median is 2; it implies that for most respondents MBO was the highest educational level. The average years of experience is 20.02 with 20 as median. The average level of solvency is 2.92. This indicates that the average solvency ratio for farms in this survey is between 50 and 60%. The median for solvency is three indicating that most farmers in this survey have solvency ratios between 40 and 60 %. The total (net) income was on average 2.60, this means on average around the 30.000 euro. The average farm size was 131.1 NGE, varying from 20 NGE of the smallest farm and 460 NGE of the biggest farm. A total of 31% of the farmers indicated they had liquidity problems last year, 71% of the farmers are sure there is a successor and 63% of the farmers had external incomes besides the farm income.

Table 4 shows the results for the variable type of farm. The research sample contains different types of livestock farmers, and this variety has some similarity with the Dutch distribution of livestock farmers as shown in appendix F. Main difference is the relative high amount of pig farmers in this thesis sample.

Table 4. Farm Type (farms can have two types of livestock)

	Nr. Farms	Percentage
Dairy Cows	31	53,4
Pigs (sow+finishers)	28	48,3
Poultry (laying henns+broilers)	4	6,9
Goats	2	3,4
Bulls	4	6,9
Other	12	20,7

The respondents that indicated they had 'other' type of livestock were mostly poultry farmers with breeding poultry (suppliers of young laying henns or young broilers)

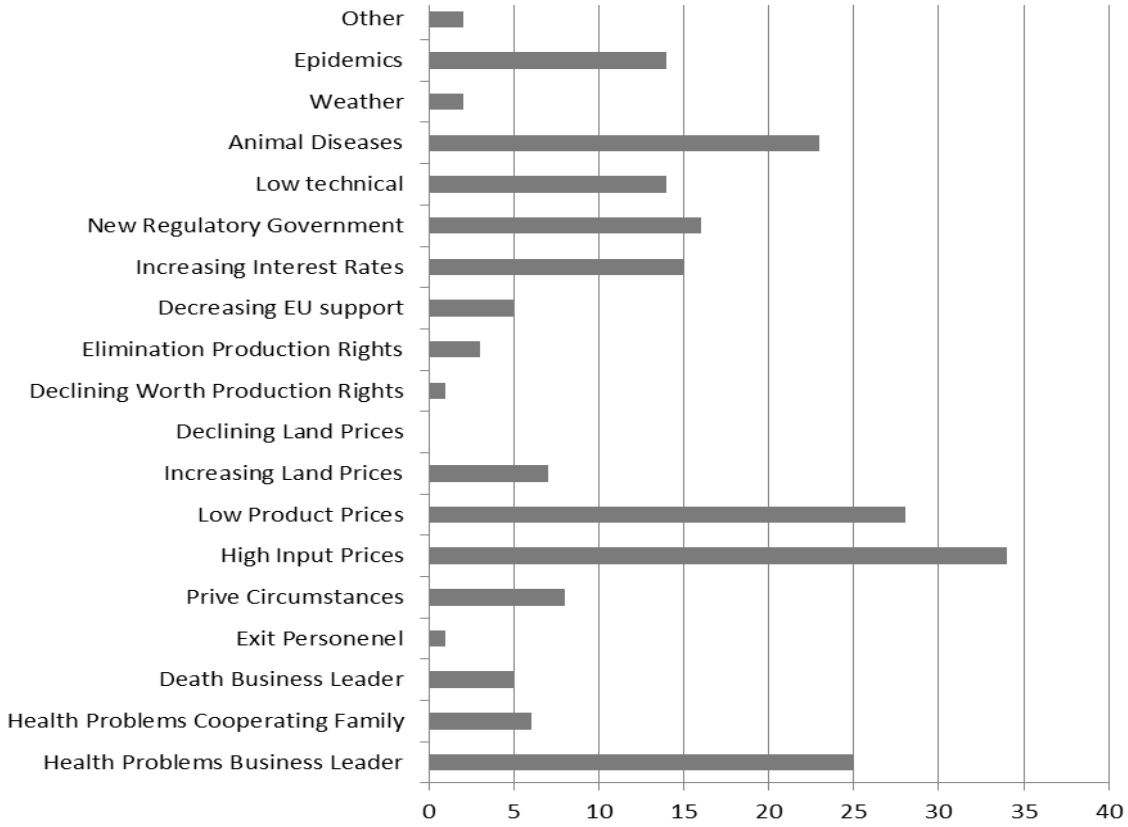
Furthermore with descriptive statistics can be analyzed which risks are identified by farmers most frequently. Figure 6 shows the results what farmers identified as threats.

Respondents were asked to identify the three risks they see as most threatening for their business. Price risks (low product prices, high input prices) are by far the most mentioned risks. After price risks, health problems of the business leader are also often mentioned as threat for their business. After these most important risks several other risks are identified in the same amounts: animal diseases, epidemics, low technical results, regulatory governments and increasing interest rates.

Because of different calculations methods it is not possible to compare the results exactly with the results of authors in the literature review. However it seems the results are different from the research done by for instance Meuwissen et al. in 2001, see appendix B. High production costs is the most mentioned risk now. In 2001 high production costs were ranked as the 15th form of important risks. The number 1 ranking of high productions costs risk has probably to do with the current animal feed prices which are record high. Epidemic animal diseases were mentioned less by livestock farmers scoring a 7th place now. In 2001 it was ranked 2nd. This has likely to do with some epidemic diseases in the years 1990-2001: classical swine fever, mouth and foot disease and BSE. Last year's there was less threat of serious epidemic diseases in Europe. Although it cannot be statistically confirmed in this

thesis it looks like that the risks that farmers experience as threatening for their businesses changes with the circumstances in time.

Figure 6. Identified risks



4.3 Correlation/T-test analysis

In this fourth section of the chapter it is analyzed if there are relations between socio economic characteristics and farmers relative risk attitude. This can give first insights in possible relation between risk attitude and socio economic characteristics.

Table 5. Test overview

Variable/Hypothesis	Test	Significant
1.Age	*Correlation*	*No*
2.Education	*Correlation*	*Yes at 0,05 level*
3.Experience	*Correlation*	*No*
4.Solvency	*Correlation*	*No*
5.Type of farm	*T-test*	*Yes at 0,05 level*
6.Successor	*T-test*	*Yes at 0,10 level*
7.Off farm income	*T-test*	*No*
8.Total income	*Correlation*	*Yes at 0,01 level*
9.Size	*Correlation*	*Yes at 0,05 level*
10.Liquidity	*T-test*	*No*

Table 6. Correlation matrix

*** Significant at the 0.01 level(one-tailed)/* Significant at the 0.05 level(one-tailed)*

	RRA	SUCC	F.TYPE	F.SIZE	LIQ	SOLV	T.INC	E.INC	AGE	EDUC	EXP
RRA	1.000										
SUCC	.239*	1.000									
F.TYPE	.232*	.109	1.000								
F.SIZE	.268*	.314**	-.059	1.000							
LIQ	-,091	-.137	-.035	-.006	1.000						
SOLV	.029	-.338**	-.098	-.119	.084	1.000					
T.INC	.321**	-.071	.188	.294*	-.083	.171	1.000				
E.INC	-.054	.313**	.100	-.113	-.069	-.104	-.010	1.000			
AGE	-.053	-.328**	-.021	-.282*	-.002	.077	-.088	-.296**	1.000		
EDUC	.314**	.301**	.022	-.030	.026	-.034	.035	.256*	-.307**	1.000	
EXP	-.008	-.337**	-.014	-.198	.013	.056	-.045	-.366**	.871**	-.390**	1.000

The results show that several socio economic variables are correlated to farmers score on the risk attitude variable. The variable total income is most strongly correlated to risk attitude both with a positive correlation of 0.321. This is significant at the 0.01 level. This is an indication that farmers with higher total incomes score higher on relative risk attitude and are therefore more willing to take risk. Also education is significantly positive correlated to relative risk attitude with a correlation of 0,314. This is an indication that higher educated farmers are more willing to take risk. The variables successor, farm type and farm size are also significantly positive correlated to risk attitude at the 0.05 level.

Because correlation analysis is not the best statistical analysis for the binary variables, an independent sample t-test was done for the variables successor, farm type, liquidity and off farm income. Significant differences were found between farmers who (probably) have a successor and farmers who are sure they don't have a successor. The risk attitude score was significant lower for farmers without a successor. Also significant differences were found between dairy and non-dairy farmers. Dairy farmers score significant lower on relative risk attitude and are therefore assumed to be less willing in taking risk.

As stated earlier, conclusions can't be drawn solely based on the bivariate and difference statistics in this paragraph. Conclusions will be drawn after it is checked in regression analysis how the relations hold when controlled for other variables. Regression analysis can also indicate how much of the variance in relative risk attitude can be explained by the model.

4.4 Multivariate linear regression.

In line with the research model, three models will be tested with relative risk attitude as the dependent variable. The first model includes farmer's personal characteristics (age, education), the second model includes farms characteristics (successor, type of farm, liquidity, solvency, external income, total income and farm size) and the third model which includes all the independent variables. In this way it becomes clear which amount of variation in relative risk attitude can be explained by the different parts of the research model (individual characteristics and farm characteristics) and the total research model. Furthermore the regression analysis can make clear how the bivariate relations found in the last paragraph hold when other variables are in stake.

4.4.1 Assumptions regression analysis

As noted in chapter three, multivariate regression analysis can be done when some assumptions about the form of the data are met.

Variables should be interval, ratio or ordinal scaled. Nominal variables can be inserted as dummy variables. One of the variables (type of farm) is nominal scaled and can't be included in the model on this scale. This variable should be converted into a dummy variable before it can be added to the model (nominal variables can only be included as dummy's). As the hypothesis about the type of farm was that dairy farmers are less willing to take risk than other farmers the variable farm type will be inserted in the model as a dummy variable with the code 0 for being a dairy farmer and 1 for not being so. In this way the variables are appropriate to use in a regression analysis. Three other nominal variables (successor, liquidity, off farm income) are already dummy variables as they can only be answered by a yes or a no.

Another requirement is the linearity, normality and homoskedacity of the residuals which can be checked by a scatterplot and a histogram of the residuals. The scatterplot in Appendix G shows that the residuals are in a quiet straight line with the predicted scores and the variance of the residuals are quiet the same for the predicted scores. Therefore it is concluded that the assumptions of linearity and homoskedacity of the residuals are met. Normalilty of the results can be visually checked by a histogram of the residuals. Appendix G also contains this histogram and makes clear that the residuals look normal distributed and therefore the assumption of normality is fulfilled.

The absence of multicollinearity can be checked by doing a VIF test. In the literature there is some discussion about which VIF value is an indication of serious multicollinearity problems. Some authors see VIF values higher as 10 as a serious multicollinearity threat, some values higher than 5 and some authors even by VIF values higher than 4 (O'Brien, 2007). Two variables in this thesis show high VIF values and are also quiet strong correlated. This are the variables age and experience (VIF > 5, correlation of 0.899). To be sure that no multicollinearity is in place one of these variables will be removed. While age seemed to be of more importance in the existing literature it is decided to remove the variable experience out of the regression model. After this removal the assumption of absence of multicollinearity is fulfilled.

The correlation matrix also indicated a positive correlation between age and education. To be sure multicollinearity is not in place model three was retested without the variable age. The results were highly similar to the model including age. It is concluded that including age causes no problems. Furthermore the variable successor showed significant correlations with multiple other independent variables (table 6). Research model 2 and 3 were first tested including the variable successor. To check the reliability of the results the regression analyses were also run without the variable successor. It seemed several results changed significantly and it was decided to exclude the variable successor from the regression analysis.

4.4.2 Regression models

The assumptions to adhere when using regression analysis are all met now, it can be used to test the research model. Three regression analyses are needed to test the relation between risk attitude and (1) personal characteristics, (2) farm characteristics and (3) the total package personal and farm socio economic characteristics.

Table 7. Regression models with average score relative risk attitude as dependent variable

*Model one and model two show the contribution of individual characteristics and farm characteristics separately. In model three the influence of all variables are controlled for each other. The tables' dairy farmers and pig farmers present the results of the regression analysis for the sub samples of farms that have dairy cows and farms that have pigs. Numbers in parentheses' show significance of the results: * = significant at 0.10, ** = significant at 0.05, *** = significant at 0.01*

	Model 1	Model 2	Model 3	Dairy Farmers	Pig Farmers
	Beta	Beta	Beta	Beta	Beta
AGE	0.006		0.012	-0.017	0.034
	(0.686)		(0.436)	(0.405)	(0.153)
EDUC	1.499		0.566	0.329	0.401
	(0.03**)		(0.009***)	(0.235)	(.281)
SOLV		.023	0.042	0.218	-0.334
		(0.877)	(0.769)	(0.235)	(0.196)
T.INC		.2634	0.221	0.098	0.068
		(0.078**)	(0.117)	(0.427)	(0.751)
E.INC		-0.154	-0.290	-0.330	0.167
		(0.648)	(0.401)	(0.482)	(0.810)
LIQ		-0.135	-0.180	-0.127	0.252
		(0.701)	(0.593)	(0.788)	(0.67)
F.TYPE		.506	.540	-	-
		(0.130)	(0.092*)	-	-
F.SIZE		0.002	.003	0.007	0.003
		(0.378)	(0.160)	(0.064*)	(0.459)
	R^2adj. = 0.048*	R^2adj. = 0.099*	R^2adj. = 0.154**	R^2adj. = 0.235*	R^2adj. = -0.073

4.4.1 Individual characteristics

The hypothesis about age stated that younger farmers would be less risk averse and therefore score higher on the relative risk attitude variable. Regression analysis shows positive coefficients in model one and three which indicates that when age go's up, willingness to take risk will also rise slightly (β =0 .012). This relation is however not significant (p = 0.436). No evidence is found that supports the hypothesis that younger farmers are more willing to take risk than older farmers. These findings are in line with the results from Meuwissen et al. (2001) and Flaten et al. (2005) who also didn't find relations between age and risk attitude. It is not in line with the results of Jing et al. (2001), Sherrick et al. (2004) and Deakin et al. (2003) who found negative relationships between age and risk attitude implying that younger farmers are more willing to take risk.

Hypothesis 2 about education stated that higher educated farmers would be more willing to take risk and therefore score higher on the relative risk attitude variable. The correlation analysis already showed a positive relation between the two variables. More evidence was found in the regression analysis. A positive coefficient of 1.499 (significant at 0.05) was found in model one. When the influence of education is controlled for the influence of other potential determinants (model three) education still has a significant contribution to the model (β =0 .566, p < .01) .While the education variable is ordinal scaled it implies that when education goes up one category, the relative risk attitude increases with 0,566 (model three). The regression analysis made clear that the significant relation found in the correlation analysis also holds when other variables are in stake. This means that sufficient evidence is found to support the hypothesis that higher educated farmers are more willing to take risk and to conclude that the level of education is of influence on farmer's willingness to take risk. This is in line with former research of Meuwissen et al. (2001), Jing et al. (2003), Aye and Oyi (2006) and Deakin et al. (2003).

The total explanatory power of the individual characteristics in the variation of relative risk attitude is 4.8. This is significant at the p = 0.10 level.

4.4.2 Farm characteristics

Hypothesis 4 stated that farms with a high solvency rate are more willing to take risk than farmers with a low solvency rate. Regression analysis found a positive coefficient between solvency and relative risk attitude. This implies that when the solvency of a business rises it is more willing to take risk. The results found in the regression are however not significant (β = 0.042, p = 0.769). The conclusion therefore is that there is not enough evidence found to support the hypothesis that high

solvent businesses are more willing to take risk than low solvent businesses. These results are not in line with earlier research of Meuwissen et al. (2001), Mischra and Goodwin (2003) and Sherrick et al. (2003). They found significant negative relationships between relative risk attitude and solvency ratio indication that farmers who are high solvent are more willing to take risk than farmers who are low solvent.

A possible explanation for this discrepancy in results could be the fact that farmers who are more willing to take risk are likely to invest more in their businesses. Last years' many farms grew fast and invested substantial amounts of capital in their farms. Investments are often financed with debt capital which reduces solvency ratios. Therefore farmers who are willing to take risk and invest in their business could have lower solvency ratios.

Hypothesis 5 was about farm type. It was suggested that dairy farmers are less willing to take risk than other sort of famers as dairy farmers are now introduced to the volatility of the free world markets. In the regression analysis positive coefficients were found in model two as well as in model three. This indicates that nondairy farmers (1) score 0.54 higher on the relative risk attitude score than dairy farmers (0) (controlled for other variables in model three). The relations found in the regression analysis are significant (β = 0.540, p = 0.092). It is concluded that there is support for the hypothesis that dairy farmers are less willing to take risk than non-dairy farmers. This is not in line with former research of Meuwissen et al. (2001) who didn't find significant differences in risk attitude between different types of livestock farmers. Flaten et al. (2005) concluded however that there are differences in willingness to take risk between conventional and organic farmers. This is more in line with the results in this thesis that willingness to take risk differs between specific sectors.

Furthermore it was stated in hypothesis 7 that farms with external incomes are less risk averse than farms who don't have external incomes. However, inverse coefficients were found (β = -0.290, p = 0.401). No support is found to expect that farmers with an external income are more willing to take risk.

Hypothesis 8 stated that farms with a higher total income are more willing to take risk than farmers with a lower total income. A significant positive correlation was found in the bivariate analysis. Controlled however for the influences of the other independent variables the, total income is found not significantly influencing relative risk attitude (β = 0.221, p = 0.117). As the total income variable is ordinal scaled, the β of 0.221 implies that when a respondent goes up one income category, the score on relative risk attitude will increase with 0.221.

No support was found for the hypothesis about liquidity.

A regression analysis was also run for the sub samples dairy farmers and pig farmers to look more closely at the influence of the type of farm. First thing to note is that these results should be interpreted with great care as the number of respondents in the sub samples is very low. However they give an indication that some relations are different between the two subgroups. Especially the results concerning solvency are remarkable. The light coefficient for the total sample increases in strength for the subsample of dairy farmers and becomes almost significant (β = 0.319, p = 0.235). Conversely, for the sub sample of pig farmers the coefficient flips to negative (β = -0.334, p = 0.196). These results indicate that pig farmers with low solvency rates are more willing to take risk. This could probably be explained by the fact that the pig sector changed very rapidly last ten years. The number of pig farms (fattening pigs) decreased from almost 13000 in the year 2000 to near 6000 in 2012 (CBS, 2013). However the total number of pigs in the Netherlands is almost the same as in in 2000. This means that farms which remained in business grew fast and 'took over' the places of quitted farmers. This rapid expansion of the remaining farms led to huge investments and lower solvency rates for pig farmers. Therefore entrepreneurs who are more likely to take risk could have lower solvency rates.

Furthermore inverse coefficients are found in the pig farmers sub sample for the variables external income and liquidity problems. The results (not significant) indicate that farmers with an external income score higher on relative risk attitude and that pig farmers with liquidity problems also score higher on relative risk attitude. While pig farmers suffered difficult financial circumstances it can be suggested that for this group it is more important to have external income sources. For the liquidity results it could possibly be so that pig farmers are more used to short term payment difficulties and that it therefore does not negatively influence risk attitude.

R square adjusted (R^2adj.) reflects which part of the variation a model explains of the dependent variable. The R^2adj. corrects the result for the number of variables included in a model. Every independent variable adds some explanatory power even if there is almost no relation. This can lead to an overestimation of the explanatory power. The R^2adj. corrects for this (Huizingh, 2006).

Model one, with only the personal independent variables has an R^2adj. score of 0.048. This means that model one declares 4.8% of the variation of the dependent variable relative risk attitude. This is significant at the *p = 0.10 level. The contribution of explanatory power from education is significant at the *p = 0.05 level. Age is found to be not significantly contributing to the model.

Model two examines the relation between the farm characteristic variables and relative risk attitude. The total explanatory power of the model is 9.9%. The explanatory power of this model is also significant at the *p = 0,10 level.

The third model tests the complete research model with all the independent variables. The R^2adj. score of the model is 0.154. The variables in the third model explain 15.4% of the variation in relative risk attitude. This result is significant at the p = 0.05 level. Significant contributing variables are education and total income.

It can be concluded that both pairs of characteristics (individual, and farm) contribute significantly to the model. However if we look to the variables separately, only a few variables are significantly contributing to the model. Only the variables education and farm type are significantly related to relative risk attitude. This finding adds further evidence to the conclusions from the bivariate analysis that education and farm type are related to farmers risk attitude and that these relations are statistically significant. Bivariate relations found for farm size and total income do not hold when controlled for the influence of the other independent variables.

4.6 Robustness check

This section will check the robustness of the results. A robustness check was also done by Meuwissen et al. (2001) who took (at random) a sub sample of 60% of the total research sample to check the internal validity of the results

A robustness test has been done by doing the regression analysis with a sub sample of the respondents. The total research sample is therefore divided in three groups based on the dependent variable relative risk attitude: a group with low scores, a group with medium scores and a group with high scores. The regression analysis was done again with the low and high score group. Very similar results were found. The explanatory power on this sub sample was slightly higher (R^2adj = 0.33) and significant at the 0.10 level. Also the direction of the coefficients was highly the same as in the original model. The results seem to support the robustness of the model. The analysis can be found in table 8.

Table 8. Regression model with subgroup low-high scores

*Model one and model two show the contribution of individual characteristics and farm characteristics separately. In model three the influence of all variables are controlled for each other. Numbers in parentheses' show significance of the results: * = significant at 0.10, ** = significant at 0.05, *** = significant at 0.01*

	Model 1	Model 2	Model 3
	Beta	Beta	Beta
AGE	0.005		0.016
	(0.840)		(0.501)
EDUC	0.626		0.761
	(0.039**)		(0.013**)
SOLV		0.019	0.046
		(0.934)	(0.831)
TINC		0.315	0.244
		(0.128)	(0.209)
EINC		-0.224	-0.356
		(0.682)	(0.517)
LIQ		-0.042	-0.108
		(0.938)	(0.835)
FTYPE		0.626	0.724
		(0.224)	(0.137)
FSIZE		0.001	.003
		(0.691)	(0.294)
	R^2adj. = 0.058*	R^2adj. = 0.044	R^2adj. = 0.165*

5. Conclusions and recommendations

5.1 Introduction

This thesis tried to give more insights in the risk experiences of livestock farmers. What are the risks they identify? How much risk are farmers willing to take? Is there a relation between risk attitude and socio economic characteristics? Is risk attitude influenced by farm's socio economic characteristics?

The questions can be answered with the statistic results from the last paragraph. The next paragraph will answer the research questions by using the statistical results from the last chapter. Paragraph 5.3 will come with recommendations for further research and for the Rabobank management.

5.2 Conclusions

Sub question one (what farmer's experiences as risk) was answered with the descriptive statistics from the last chapter. Respondents made clear what they experienced as potential risks. A histogram was created from the answers which give a good overview of the results. What farmers experience as risks can be seen in figure 6. It is clear that price risks (high input prices, low product prices) are by far the most mentioned risks. After these price risks, health problems or death of the farm operator are experienced as most severe threats. The results were compared with the results of experienced risk identified by Meuwissen et al. (2001). Results indicate that the experienced risks are quite different from the ones identified in 2001. This could be an indication that experienced risks fluctuate with the circumstances over time. The current experienced threat of high input price risk could be caused by the high feed prices at the moment. This was not such a threat in 2001. Contrary, the fear for epidemic diseases has strongly declined. Probably because there were less severe epidemic diseases present in Europe. The ranking of risk concerning the health of business leader and business employees is similar to the results found by Meuwissen et al. (2001) and Flaten et al. (2005). These types of risks seem to be experienced on a constant base and not fluctuating in time.

Sub question two was about *how* farmers experience risk taking (farmers risk attitude), the dependent variable in this thesis. Different authors define risk attitude somewhat different. Flaten et al. (2005) talk about Comparative Risk Attitude (CRA), Meuwissen et al. (2001) about Relative Risk Attitude, Jing et al. (2003) about the 'Attitude toward Risk and Risk-Taking Behavior'. Generally, these definitions describe farmer's willingness to take risk compared to others. Literature was studied to

discover how farmers experienced risk in the past, and in the survey questions were included to measure farmer's current willingness to take risk compared to colleagues, also called relative risk attitude in this thesis. In the literature relative risk attitude is often measured by asking farmers their willingness to take risk compared to colleagues on several matters in their entrepreneurship. A similar method was used in this thesis to measure this dependent variable. It can be seen in in Appendix H that farmers are most willing to take risk concerning production and financial/strategic issues. Willingness to take risk on marketing issues looks to be lower. Furthermore it seems that farmer's willingness to take risk has either not declined or increased in the past ten years. The results are comparable to the ones found by Meuwissen et al. (2001).

Sub question three tries to give insights in the relation between the socio economic variables included in the research model and the dependent variable relative risk attitude. Bivariate statistics and statistics to identify differences were used to answer this question and an overview of the results is shown in table 9.

Table 9. Correlation/T-test overview.

** = significant at 0,10 / ** = significant at 0,05 / *** = significant at 0,01*

Variable	Significant
Age	
Experience	
Education	**
Type of farm	**
Solvency	
Liquidity	
Successor	*
Off farm Income	
Total Income	***
Farm Size	**

Correlation analysis was used to examine the relation between relative risk attitude and the ordinal and interval scaled independent variables. T-tests were used to check relations between the binary independent variables and risk attitude.

Results indicated that there were significant (positive) relations between relative risk attitude and education, total income and farm size. This means that higher education, higher total income and higher farm size is associated with higher scores on relative risk attitude. Significant differences were found in the willingness to take risk between groups with a successor and without a successor. The group with a successor scored significantly higher on the relative risk attitude variable indicating they are more willing to take risk.

Further analysis was done by means of regression analysis. This way of investigating relations between variables is more accurate because it takes in consideration the influence of multiple variables on the dependent variable. Within the regression models more evidence was found for the relation between relative risk attitude and farmer's education and farm type. These variables contributed significant to the complete research model. Based on the results of the bivariate and regression analysis it can be concluded that higher education leads to a higher willingness to take risk. This is in line with the results found by Meuwissen et al. (2001), Jing et al. (2003), Aye and Oyi (2006) and Deakin et al. (2003). It can also be concluded that dairy farmers are less willing to take risk than other farmers.

Further analysis was done to check more specific the differences between the two biggest sub groups: dairy farmers and pig farmers. The number of respondents in the subgroups is very low and the results should not be seen as hard statistical evidence. There are however indications that there are differences in how relative risk attitude is influenced by socio economic variable between these biggest sub groups.

Explanatory power of three models was also analyzed with regression analysis. The first research model contained only individual characteristics. This model explained 5% of the variation in the dependent variable. Research model 2, containing farm characteristics explained 10% of the dependent variable. The complete research model explained about 16% of the variation in relative risk attitude.

The results imply that educational level and type of farm are influencing the risk attitude of livestock farmers. However, the total explanatory power of the models is rather low. Only a part of risk attitude can be explained farms socio economic characteristics. This is in line with the results from Meuwissen et al. (2001) and Flaten et al. (2005). The researches of Jing et al. (2003) and Aye and Oyi (2006) found higher explanatory power of their models.

Although the results of this thesis confirm there is a relation between some socio economic characteristics and relative risk attitude it has to be concluded that socio economic characteristics explain only a part of relative risk attitude. As several other authors suggested in the past it has to be confirmed again that relative risk attitude is likely to be declared more by other personal factors. It looks like the highly volatile market circumstances did not change the way farmers relative risk attitudes are developed. Just like the existing literature on the subject acknowledged, it is suggested again that the way farmers experience risk and the willingness of taking risk is influenced by other personal influences, characteristics or experiences.

5.3 Recommendations Rabobank

This recommendation is written while keeping in mind that the Rabobank clients "*demand more from our bank than only the lowest price. Market research made clear that our clients want to be advised about developments in their sector by an expert"* (Rabobank, 2012). Especially the descriptive statistics gave a lot of information concerning farmer's view of risks. And although respondents were not questioned about the role of the Rabobank , some respondents stated in the suggestion box that Rabobank should be more active in this field. This findings lead to some recommendations for the Rabobank management.

The thesis made clear that risk is an actual topic for livestock farmers. 78% of the farmers indicated that risks for their business have increased last years and a few farmers stated in the suggestion box at the end of the survey that the Rabobank could probably do something with the information of the survey. Citation of two respondents: "*Rabobank with her background could more pro-actively communicate about his topic with clients*" and "*I hope the bank can use this information to inform us better about risk in the future*". The fact that respondents were not asked about the Rabobanks role but gave opinions about how they think about it indicates that there are chances for the Rabobank on this domain.

Also the descriptive statistics gave some interesting information about some specific aspects. Around 50% of the respondents are worried about prices risks: high input prices and low product prices. These high numbers probably have to do with the strong increase in animal feed prices last year. The Rabobank possesses an enormous amount of knowledge about raw materials markets (grain, soybeans, corn). This information could probably be better communicated to farmers. Information evenings which are organized every year are events that can be used to communicate with farmers about these issues and the vision the Rabobank has. Maybe the Rabobank can also better educate clients in the field of risk management. Price risks can be decreased with for instance the trading in futures. These are topics farmers do not know much about (as indicated by the research of the Deutsche Bank, 2010)

but it can be very useful in diminishing daily risks. Use of risk management tools can also decrease risks for the Rabobank.

The general advice for the Rabobank management therefore is to more actively share the knowledge the Rabobank has concerning risk issues. Although a precise role the bank could play should be investigated in more depth, the information suggests that there is a need for information. Information about certain risk issues can increase client's knowledge. This may reduce the uncertainty which is present right now at the livestock farmers.

5.4 Study limitations

Discussed are some limitations of the research concerning the data, design and conclusions.

Probably the most obvious constraint is the sample size. The total number of 62 respondents is not high. This can influence the statistical conclusion validity negatively as already mentioned in chapter 4 when the validity issues were discussed. In light of this threat it is important to mention that the tests are carefully chosen given the characteristics and constraints of the data. This is important to create results as accurate as possible.

Furthermore generalizability will be limited. The survey was held on one type of farmers in a specific geographical area. This reduces the possibility of generalizing to other types of business in other geographical areas as for instance local cultural contexts could have influence the results.

A third point of criticism is that the survey was held on one moment in time. It could be influenced by circumstances present at that moment. Food prices were record high at the moment of the survey. This could probably have influenced livestock farmers current risk attitudes. For a better reflection the survey should have been held two times with an interval of a year. This should increase the validity of the research.

5.5 Future research

As this thesis, in line with former literature, cannot explain much of the variation in relative risk attitude there are enough points of interest for research in the future. Besides that, for the Rabobank it became clear that risk is a topic of interest for farmers. Future research could probably make clear how the Rabobank can anticipate on this and serve the clients better on this topic.

Recommendations Literature

A suggestion for further research can be to measure more accurate the constructs that are used in the research. For instance the variable solvency was measured as the part of debt in relation to total assets. However, a solvency rate of 30% for a big modern farm with good technical results cannot be compared with a solvency rate of 30% for a small, old farm that underperforms in comparison to the market. To better describe and articulate such circumstances more accurate results could probably be measured.

In line with former research about the subject, this thesis concluded that socio economic farm characteristics cannot explain very much variation in the dependent variable risk attitude. Suggested is again that other (personal) characteristics have an influence on these risk attitude. The goal to explain variation in relative risk attitude is therefore not fully accomplished. Future research could focus on this part to obtain a more complete view of how risk attitudes develop. As the results indicate differences in the influence of socio economic characteristics on risk attitude between different subgroups, future research could also focus on this in more depth.

Recommendations Rabobank

For the Rabobank it can be of more interest to know what clients *exactly* expect from their bank or account manager regarding risk (management). In the survey 78% of the respondents stated that risks have increased. This is a clear indication that a lot of farmers are worried about the influence of certain risks on their businesses. But what is the exact role for the Rabobank in the eyes of the clients? Although it is out of the scope of the research this results could be linked to the use of risk management tools in the future. Especially for the prices risks often mentioned by farmers, a lot of strategies exist to deal with these uncertainties. Why don't farmer use these tools (as became clear from the research of the Deutsche Bank)? When it is clear what the difficulties for farmers are to use certain risk management tools and know what farmers expect from the Rabobank it is possible for the Rabobank to more accurately serve the clients with the information farmers are in need off. It should also be noted that farmers who use certain risk decreasing tools also decrease the risk the Rabobank is exposed to. Especially farmers with low solvency ratios (implying higher risks for the bank) are more vulnerable to certain risks which could be decreased by using certain risk management tools. In depth knowledge about this topic could benefit the clients and the Rabobank.

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Appendix A Rentability Lean Hogs Netherlands 2006/2010 (Rabobank.nl, 2012)

Table 10. Rentability Lean hogs

	revenue/kg meat	Price piglet 25kg	Turnover	Feed price 100kg	Feed cost per kg grow	Feed costs per pig place per year	Feed profit
2006/2010	*1,29*	*38,51*	*241,80*	*23,27*	*0,61*	*158*	*68*

Average feed profit (gross margin) period 2006/2010 (total revenue per pig place minus buying piglet and animal feed) was €68,-. Over a longer period of time 'feed profit' has been €74. Conclusion: average gross revenue has decreased last four years by more than 8%.

Appendix B Identified Risks 2001

Meuwissen et al. (2001) asked their respondents to identify how relevant the following risks where for their business on a five point Likert scale.

Source of risk	Average
Meat price	4.41
Epidemic animal diseases	***4.41***
Milk price	4.36
Death of farm operator	4.15
Technical results finishing animals	4.13
Health situation of farm family	3.91
Environmental policy	3.86
Disability/health of farm operator	3.69
Family relations (e.g. divorce)	3.64
Animal welfare policy	3.57
Consumer preferences	3.47
Value of production rights	3.47
Changes in interest rates	3.44
Production costs	***3.33***
Milk yield	3.28
Elimination of government support	3.14
Animal diseases (non-epidemic)	3.07
Changes in farm capital (land, machinery)	2.64
Ability to redeem loans	2.60
Division of tasks within farm family	2.52
Technology	2.24
Land rent	2.06

Appendix C Normality test total score risk attitude

Table 11. Shapiro Wilk test

	Shapiro-Wilk test		
	Statistic	df	Sig.
AverageScoreRiskAttitude	0.970	62	0.131

Appendix D Multicollinearity statistics

Table 12. Multicollinearity statistics

	Collinearity Statistics	
	Tolerance	VIF
FarmType	,922	1,085
Succesor	,638	1,568
FarmSizeNge	,676	1,480
TotalIncome	,778	1,286
ExternalIncome	,757	1,321
LiquidityProblems	,945	1,058
Solvency	,824	1,214
Age	,175	5,716
Education	,729	1,372
Experience	,169	5,912

Appendix E Questionnaire

This appendix shows the questionnaire that has been send to the respondents. For the statements 1 till 4 it is also showed how the scores are defined.

Note: the survey also contains questions which are not used for this thesis but other purposes

Enquête Risicohouding Veehouderij

U wordt gevraagd ongeveer 20 stellingen en vragen te beantwoorden. De vragenlijst is op te delen in drie delen: de eerste groep vragen tracht duidelijkheid te geven over uw bereidheid tot het nemen van risico's. Vervolgens vragen we u in het tweede deel om enkele van u individuele kenmerken en in het derde deel over een aantal van uw bedrijfskenmerken. Het doel van deze enquête is om meer inzicht te krijgen over *hoe* u als agrarisch ondernemer risico nemen ervaart en *wat* u als risico's ervaart.

Januari 2013

Vragenlijst

De volgende stellingen trachten te bepalen in welke mate u bereid bent risico's te nemen in uw agrarisch ondernemerschap. U kunt op elk van de vier stellingen (4 verschillende vlakken binnen ondernemerschap) aangeven hoeveel risico u op dat vlak durft te nemen t.o.v. collega's. U kunt dit op een schaal van 1 tot 5 (weinig/veel) aangeven.

1 Stelling: ik durf meer risico te nemen dan collega ondernemers wat betreft productie vraagstukken. Onder productie vraagstukken wordt verstaan: het dagelijkse management van uw bedrijf. In welk mate durft u in uw dagelijkse bedrijfsvoering veranderingen door te voeren om uw technische resultaten en saldo te verbeteren. Denk bijvoorbeeld aan het gebruik van een nieuw voer, de aanschaf van nieuwe bedrijfsapparatuur enz..

Oneens	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*Eens*

2 Stelling: ik durf meer risico te nemen dan collega ondernemers wat betreft financiële issues.
Onder financiële vraagstukken wordt verstaan: beslissingen van invloed op uw bedrijf over een langere periode. Denk bijvoorbeeld aan de bouw van een nieuwe stal, de keuze voor een vaste of variabele rente, het gebruik van bepaalde verzekeringen enz..

Oneens *0* *0* *0* *0* *0* *0* *0* *Eens*

3 Stelling: ik durf meer risico te nemen dan collega ondernemers wat betreft marketing issues.

Onder marketing issues wordt verstaan: uw relatie met externe spelers. Hoe makkelijk wisselt u van leveranciers of afnemers, durft u te kiezen voor een nieuwe markt voor uw afzet enz..

Oneens *0* *0* *0* *0* *0* *0* *0* *Eens*

4 Stelling: ik durf meer risico te nemen dan collega ondernemers wat betreft ondernemen in het algemeen.

Oneens *0* *0* *0* *0* *0* *0* *0* *Eens*

Algemene vragen ondernemer

5Wat is uw leeftijd in jaren?

... jaar

6 Wat is uw geslacht?

0 *Man*
0 *Vrouw*

7 Wat is uw hoogst genoten opleiding?

0 *Middelbare school*
0 *MBO*
0 *HBO*
0 *WO*

8 Hoeveel jaar bent u zelfstandig ondernemer?

... jaar

9 Mijn partner heeft invloed op beslissingen die ik neem en die risico met zich meebrengen

Oneens *0* *0* *0* *0* *0* *Eens*

Geen partner *0*

10 Hoe belangrijk is het in uw ogen voor de continuïteit van uw bedrijf om te investeren in zaken op het gebied van maatschappelijk verantwoord ondernemen? (bijvoorbeeld verbetering dierenwelzijn en vermindering milieubelasting)

Onbelangrijk 0 0 0 0 0 0 0 Belangrijk

De volgende vragen proberen enkele algemene bedrijfskenmerken van uw bedrijf in beeld te brengen.

11 Wat zijn volgens u de belangrijkste risico's voor uw bedrijf? Kruist u de drie belangrijkste aan.

0 *Ongunstige weersomstandigheden*
0 *Hoge prijzen inkoop (voer, gezondheidszorg, energie, overige benodigdheden)*
0 *Lage prijzen verkoop (lage melk, vlees, ei prijs)*
0 *Vermindering bedrijfstoeslagen*
0 *Nieuwe regelgeving dierenwelzijn*
0 *Dierziektes*
0 *Gezondheidsproblemen bedrijfsleider*
0 *Gezondheidsproblemen meewerkende familieleden*
0 *Lage technische resultaten bedrijf*
0 *Dalende waarde productierechten*
0 *Privé omstandigheden*
0 *Nieuwe regelgeving milieu*
0 *Stijgende grondprijzen*
0 *Dalende grondprijzen*
0 *Overlijden bedrijfsleider*
0 *Overig, te weten ……*

12 De risico's voor mijn bedrijf zijn de afgelopen jaren toegenomen

0 Eens

0 Oneens

13 Wat is de hoofdtak van uw bedrijf?

0 Melkvee

0 Leghennen

0 Vleeskuikens

0 Fokzeugen

0 Vleesvarkens

0 Vleesstieren

0 Geiten

0 Overig, te weten ……

14 Kunt u een inschatting maken van de solvabiliteit van uw bedrijf (eigen vermogen/totaal vermogen). Het solvabiliteitspercentage geeft aan hoe groot uw eigen vermogen is t.o.v. het totaal vermogen: 100% betekent dat u geen vreemd vermogen heeft.

0 0 - 20%

0 21% - 40%

0 41% - 60%

0 61% - 80%

0 81% - 100%

15 Heeft u in het afgelopen jaar op enig moment te maken gehad met liquiditeitsproblemen? (het niet kunnen doen aan betalingsverplichtingen op de korte termijn)

0 Ja

0 Nee

16 Heeft uw bedrijf een opvolger?

0 Ja

0 Nee

0 (Nog) niet bekend

17 Wat is de rechtsvorm van uw bedrijf?

0 Maatschap, Eenmanszaak, V.o.f. (personenvennootschappen)

0 B.v.

18 Is er binnen uw huishuiden inkomen van buiten het bedrijf?

0 Ja

0 Nee

19 Wat is het totaal netto jaarinkomen van uw huishouden in euro's? (inkomsten bedrijf + overige inkomsten)

0 0 – 20.000

0 20.001 - 40.000

0 40.001 – 60.000

0 60.001 – 80.000

0 80.001 +

20 Wat is de grootte van uw bedrijf? Geeft u per diercategorie de omvang van de veestapel aan.

Melkvee (exclusief jongvee)	*……*	*stuks*
Jongvee	*…….*	*stuks*
Vleesvarkens	*…….*	*stuks*
Zeugen (incl. big)	*……*	*stuks*
Leghennen	*…….*	*stuks*
Vleeskuikens	*……*	*stuks*
Melkgeiten	*……*	*stuks*
Vleeskalveren	*……*	*stuks*

Overige,……

Appendix F Livestock farms in the Netherlands (Wageningen University)

Number indicates the number of farms in the Netherlands with a certain type of livestock. This means one farm can fall in two categories when it holds two types of livestock.

Table 13. Livestock farm Netherlands

	Nr. of farms (2011)	In %
Dairy	19.000	63,2
Pigs (sows + finishers)	6.500	21,6
Poultry (laying henn + broilers)	2.400	7,9
Bulls	2.000	6,7
Geiten	170	0,6

Table 14. Livestock farm research sample

	Nr. Farms	Percentage
Dairy Cows	31	53,4
Pigs (sow+finishers)	28	48,3
Poultry (laying henns+broilers)	4	6,9
Goats	2	3,4
Bulls	4	6,9
Other	12	20,7

Appendix G. Scatterplot Residuals

Figure 7. Scatterplot

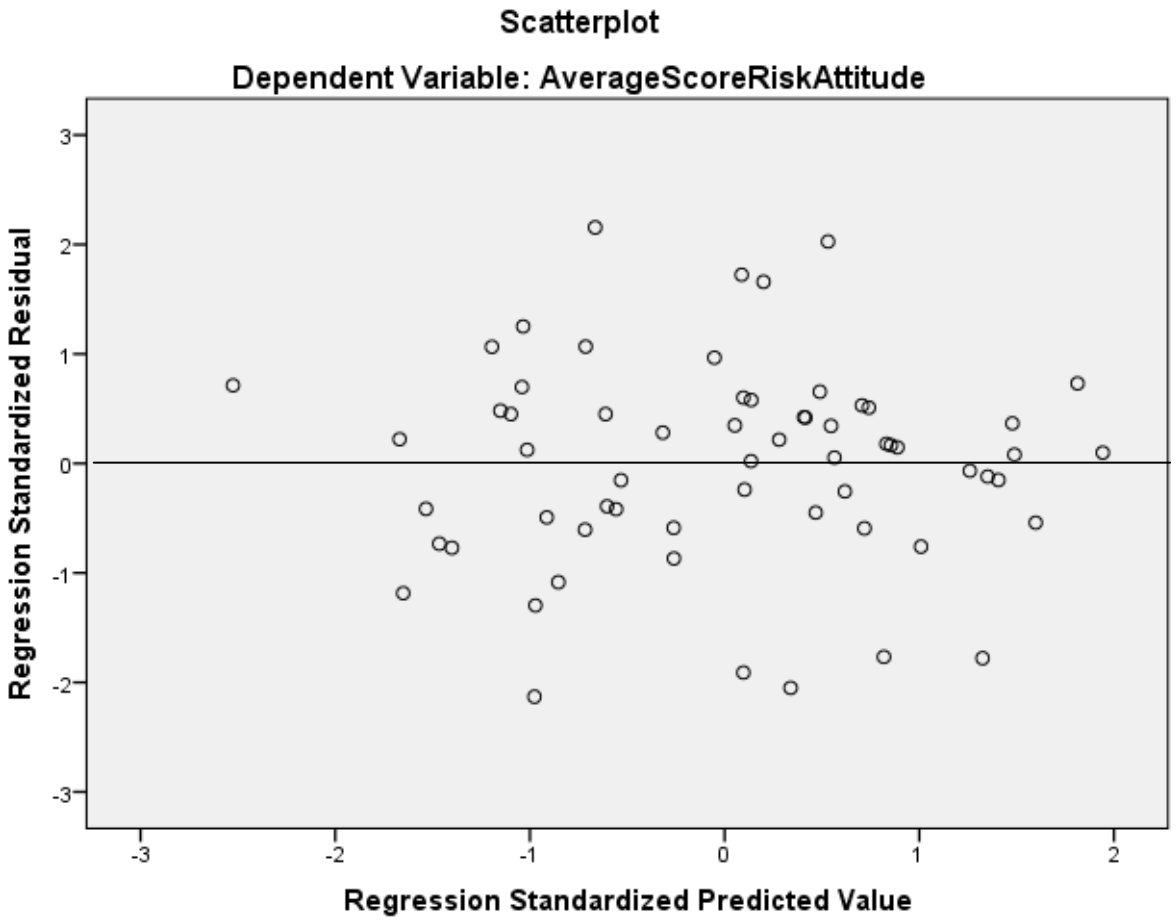
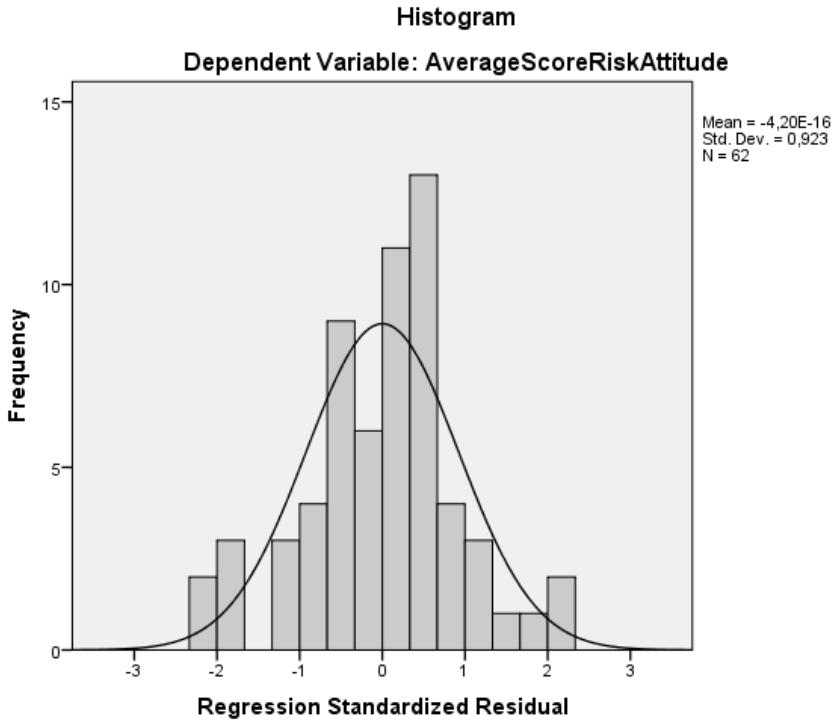


Figure 8. Histogram residuals



Appendix H. Risk attitude scores

Figure 9. Willingness to take risk production issues

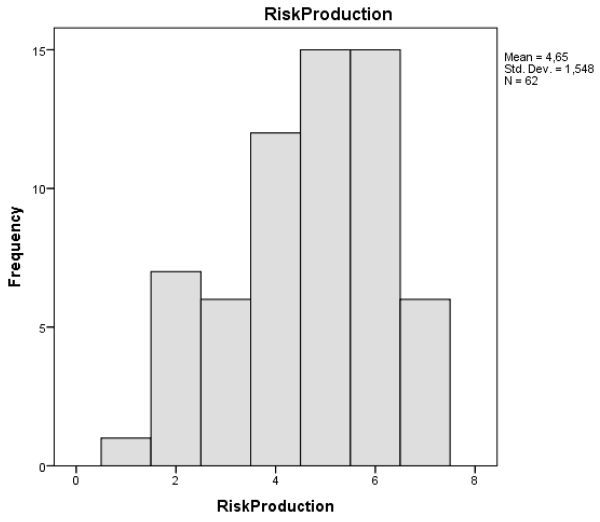


Figure 10. Willingness to take risk financial/strategic issues

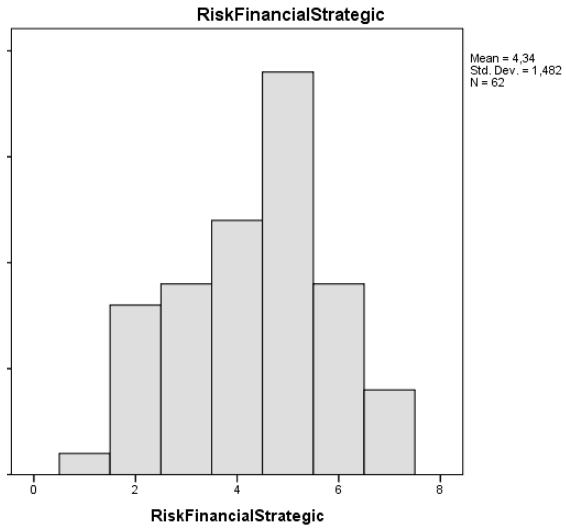


Figure 11. Willingness to take risk marketing issues

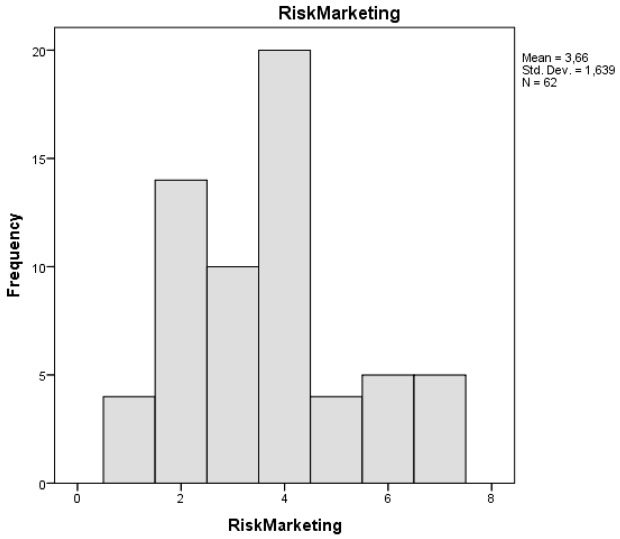


Figure 12. Willingness to take risk in general

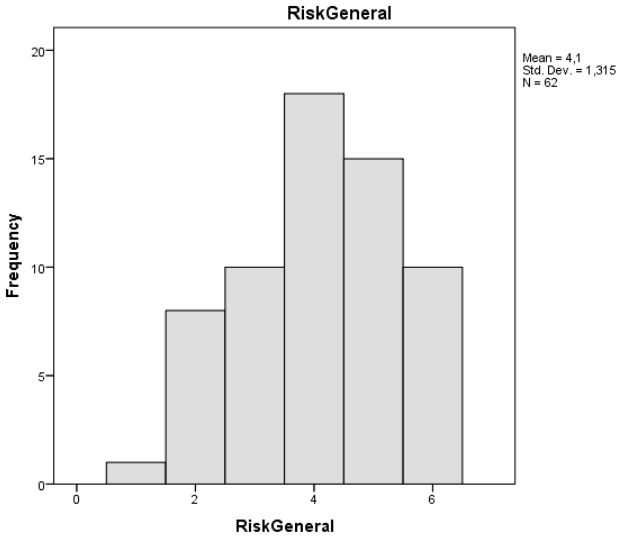
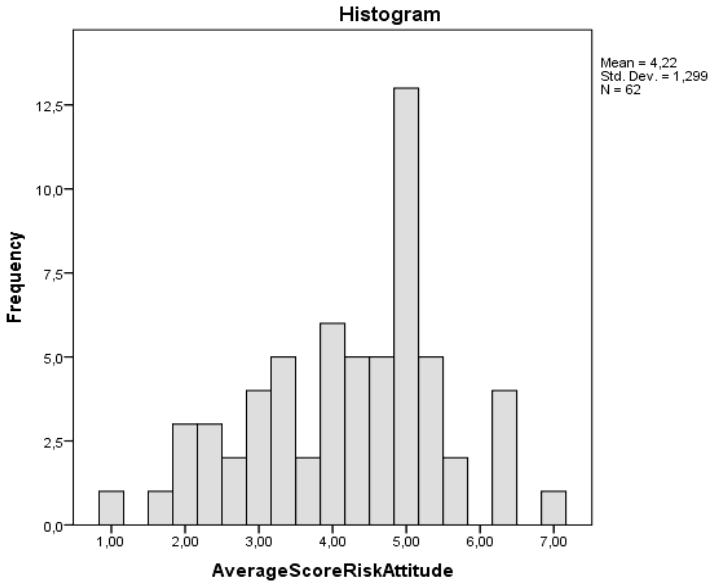


Figure 13. Willingness to take risk, average score questions 1-3 (dependent variable)



Overview of answers on questions concerning willingness to take risk in the research of Meuwissen et al. (2001).

Indicators to measure relative risk attitude and the percentage distribution of respondents over categories

	1 Don't agree (%)	2 (%)	3 (%)	4 (%)	5 Fully agree (%)
I am willing to take more risks than my colleagues with respect to					
1. ... production	15	15	47	18	5
2. ... marketing	20	24	40	13	3
3. ... financial issues	15	20	35	24	6