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The Effect of Microinsurance on Investment Levels among Farmers

Evidence from Zambia

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Abstract

Variable incomes and under-investment due to risks of economic loss is an often overlooked aspect of poverty. Affordable insurance against risks such as loss of harvest due to low rainfall may be a key factor in reducing poverty. This study aims to examine the relationship between microinsurance against weather-related risks and levels of investment among covered farmers. The analysis is done by reviewing relevant literature, by developing a model of a farmer's investment decisions and by distributing a survey among farmers in and around Choma in Zambia. The analysis finds that provision of microinsurance is positively correlated with investment in farmland and new types of crops. The findings support the view that farmers are more inclined to allocate resources into more productive assets when some risks are mitigated.

Keywords: microinsurance, insurance, investment, Zambia, Choma

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Contents

1 Introduction

An aspect that is often overlooked when it comes to economic poverty is that the people who live on two dollars a day do not literally receive that amount every day. Figure 1 shows how maize prices have varied in Uganda in recent years. Not knowing at what price their products can be sold can be detrimental to a smallholder farmer, but price risk isn't the only type of risk that they face. Income shocks from bad harvests, sickness or crime can have long-lasting effects on both individual farmers and whole communities. It is therefore highly relevant to discuss the possibilities of providing affordable insurance to poor households across the world, partly as a way of directly improving livelihoods but also as a way to promote economic growth.

The goal of this study is to investigate the relationship between the provision of weather index insurance and the levels of investment and risk-taking among farmers. This is done by researching a sample of farmers located in and around the town of Choma in Zambia. Some of the farmers are connected to the Lima Credit Scheme, a programme organized by the Zambia National Farmers' Union (ZNFU) which provides farmers with agricultural input as well as a rainfall insurance. The participants of the study were given a survey with questions regarding their household, their involvement in insurance programmes and their investment levels.

The main finding of the study is that there exists a significant and positive relationship between participation in microinsurance and increased levels of investments in two different areas, namely in land and in new types of crops. These results are in concurrence with what other academics in the field have found. In 2012, Dean Karlan and his colleagues performed a similar study in Ghana. They found that farmers covered by rainfall index insurance made significantly larger investments on their farms (Karlan, Osei, Osei-Akoto, & Udry, 2012). Another study, performed in India, found that insured farmers tended to substitute their investments toward higher-risk, higher-return crops (Cole, Gine, & Vickery, 2014). This effect was particularly concentrated among more highly educated farmers. The same conclusions have been drawn about sow-raising farmers in China (Cai, Chen, Fang, & Zhou, 2014) and rice farmers in India (Mobarak & Rosenzweig, 2012).

Apart from reviewing literature on the subject and analysing the results of the survey, this study also presents a theoretical model of the investment decisions of a farmer and how they change when the farmer is insured against weather-related risks. The model shows why a farmer faced with the decision of how to allocate their money between consumption and investments chooses to allocate a bigger part into investments if the farmer is insured.

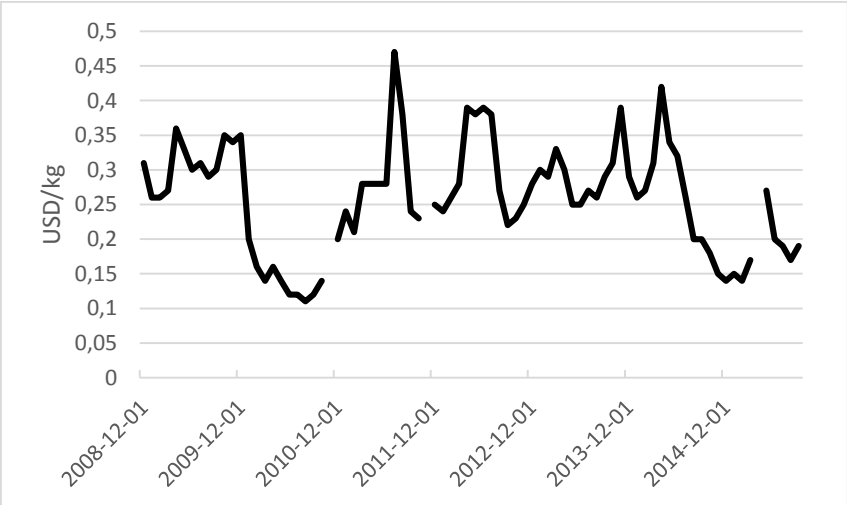

Figure 1. Wholesale prices of maize in Uganda (Food Security Portal, 2015)

2 Research questions

The aim of this study is to investigate the effect Weather Index Insurance has on smallholder farmers, in relation to their levels of investments and risk-taking. The study reviews the concepts of microinsurance and its place in Zambia, as well as look at relevant literature to understand what other studies have found about the subject. The aim is then to develop an understanding of why an insured farmer might choose to allocate resources into more productive assets. Finally, this study will investigate the empiric effects of microinsurance by distributing a survey to Zambian farmers.

The two main questions this study seeks to answer are:

- Do smallholder farmers' investments increase as a result of microinsurance?
- What mechanisms lie behind the relationship between microinsurance and investment levels?

3 Background

In this chapter, general information about the study area and involved organizations will be covered. After a look into the history of agricultural policy in Zambia, an overview of how insurance works is provided. This leads into the concept of microinsurance and in turn index insurance. The goal is to provide a background for the theory that follows as well as to introduce the region in which the study was performed.

3.1 The study area

Zambia is a republic situated in the middle of southern Africa. The capital city is Lusaka, located in the south-central part of the country. Zambia has a land area of 752 618 km^2 and the land is divided into ten provinces. This study was performed in the town of Choma in the southern province, approximately 300 kilometres south-west from Lusaka. In the north of the country is the Copperbelt region, where the main part of Zambia's mining industry is situated.

The territory of Northern Rhodesia was colonized by the British Empire in 1891 and so remained until independence in 1964, when it changed name to Zambia. It stayed under one-party rule under President Kenneth Kaunda until 1991 and has since that been led by five different presidents. At the time of writing, Edgar Lungu is the sitting president. Most Zambians are part of one of several different tribes and there are said to be more than 70 languages spoken in the country. The main religion is Christianity and there are approximately 15 million people living in the country.

The age distribution of Zambia is skewed and life expectancy is comparatively low, due in large part to the prevalence of HIV/AIDS, which among adults is estimated at 12.5 percent. The median age is 16.7 years and life expectancy is 52.2 years.

3.2 Economy and agriculture in Zambia

The GPD per capita of Zambia is 4 100 dollars, ranking 177 in the world. (CIA, 2014) Historically, mining has been the backbone of Zambia's economy. But although Zambia's economy relies heavily on the outputs of its copper mines, agricultural output accounts for about 20 percent of the GDP. The agricultural sector also provides employment to 85 percent of the labour force (Central Intelligence Agency, 2015). Therefore, agriculture has become a major priority for the government and development agencies when it comes to ensuring food security, income generation, creation of jobs and poverty reduction (Zambia Development Agency, 2011).

In 2007, it was estimated that 85 percent of adults in Zambia do not have access to formal financial services (Honohan, 2007). Formal financial services include access to loans from banks, access to savings accounts and access to insurance services. Providing these kinds of services to farmers of the developing world may be an important aspect of achieving growth, as farmers often make up a considerable part of the population and have much potential to invest and increase their productivity. There is reason to believe that the number of Zambians with access to formal financial services has increased since 2007, primarily thanks to Airtel's mobile payment programme, making it possible for people to send and receive money as well as paying bills, saving and borrowing money.

Agriculture has been identified as the main driver of the economy to complement mining. The total land area of Zambia is 75 million hectares and 58 percent of the land is classified as medium to high potential for agricultural production (Ministry of Agriculture and Livestock, 2013). Of these, only 1.5 million hectares is cultivated every year (Zambia Development Agency, 2011). Zambia has a huge capacity for agriculture in terms of suitable land, water for irrigation and labour. As such, the agricultural sector in Zambia has enormous potentials for improvement and expansion. Expanding

agriculture in Zambia means not only increasing exports and national revenue but also reducing poverty. The agricultural sector is responsible for between 16 and 20 percent of the Gross Domestic Product and provides an income for more than 70 percent of the people living in the country. The main farming season stretches from November until March.

Two organizations are central in the lives of many smallholder farmers in Zambia. First, the Zambia National Farmers' Union (ZNFU) which works as the link between farmers and government. They are also responsible for many projects such as self-help groups, information distribution and microfinance programmes, such as the one investigated in the current paper. The other organization is the Food Reserve Agency (FRA), which is a state-owned grain reserve. They buy agricultural output directly from smallholder farmers and account for a vast majority of sales in Zambia (Mason, Burke, Shipekesa, & Jayne, 2011). How these organisations started will be covered in the next chapter.

3.3 History of agricultural policy in Zambia

To understand current food policy issues in Zambia and many other African countries, one has to explore the historical evolution of agricultural policy, starting in colonial times.

During the colonial period, the British set up a sophisticated system in order to collect taxes, distribute justice, keep order and indirectly govern their African colonies. Farmers were generally dealt with by forcing them to sell all their produce to marketing boards, organisations set up by the colonial office which were basically strategic grain reserves (Jones, 1987). The justification for marketing boards was that they would absorb the price fluctuations of the world market, thus saving the farmers from the danger of not knowing at what price they could sell their produce. It seemed a good idea, but in reality the monopsonistic nature of marketing boards led to high expenditures for overhead and administration (Bates, 1981). Moreover, the differences in world crop prices and domestic prices was used as a revenue source for policy makers. Typically, the revenues that could be tapped from farmers was used to fund industrial and urban development (Bates, 1981).

This was certainly the case In Northern Rhodesia (today Zambia), where the colonial market board strategy took the form of the Maize Control Board, established in the 1930s (Adam, Collier, & Gondwe, 2014). The revenues were in this case used to fund mining developments in the Copperbelt region, but the Maize Control Board also served the explicit purpose of protecting white settler farmers from native competition (Vickery, 1986). A third function of the Maize Control Board was to promote and subsidize the production of maize, which is still today considered the country's principal food staple (Hichaambwa et al., 2012).

Zambia has a strong tradition of cooperatives, dating as far back as 1914 when the first informal co-operative society of white farmers was registered (Lombard, 1971). The colonial rule prohibited Africans from forming agricultural cooperatives and the colonial government worked actively at undermining the influence of native farmers. Despite this, several cooperatives emerged among small-scale farmers which ultimately forced the colonial government to recognize them legally in 1947, although the colonial definition of "farmer" still explicitly excluded Africans (Öjermark & Chabala, 1994). The Northern Rhodesia Farmers' Union (NRFU) was the biggest representative organization for farmers, but was in reality a union for European commercial farmers. After independence in 1964 the definition of farmer was changed to include Africans and the NRFU was transformed into the Commercial Farmers Bureau of Zambia (CFB) (Öjermark & Chabala, 1994). Today the organization lives on as the Zambia National Farmers' Union (ZNFU) and is recognised as one of southern Africa's most effectual cooperatives.

At independence in 1964 the Maize Control Board became the National Agricultural Marketing Board (NAMBOARD) but it continued its strong control of the agricultural market. NAMBOARD guaranteed

input and output markets for maize and functioned as a way for the government to subsidize fertilizer and promoting animal traction and tractor ploughing (Hillbom & Svensson, 2013). The government's policy achieved great success during the 1970s and 1980s and the country's yields per hectare were trending upwards (Howard & Mungoma, 1996). In the late 1980's however, subsidy costs started contributing to macroeconomic instability and donor pressure led to the abolition of NAMBOARD in 1990. This led to a distinctive fall in maize production as farmers turned to other crops such as cassava, groundnuts and sweet potatoes. In eastern Zambia, cotton farming became increasingly popular.

However, government intervention in the maize market soon returned in the form of the Food Reserve Agency (FRA), which was established in 1996 but started active trading of maize in 2003 (Hichaambwa et al., 2012). FRA was tasked with holding strategic grain reserves in order to dampen price variability and provide liquidity. It soon took on the additional task of buying maize in remote areas where production was unlikely to become profitable under commercial conditions, acting as a price floor (Weber, Jayne, Tembo, & Chapoto, 2009). In recent years, FRA has become the dominant buyer on the market. In 2011 FRA accounted for 80 percent of smallholder maize sales (Mason et al., 2011).

Understanding the history of agricultural policy in Zambia is important in order to understand why the current system looks like it does. The understanding of history also tells us that Zambia, along with many African states, is still adapting to many recent reorganizations. They are also changing and developing rapidly, leading to a great deal of dynamism but also a lack of stable institutions and infrastructure for companies to act in.

3.4 Insurance

This section will briefly introduce the idea of insurance and the challenges it faces, before progressing into the concepts of microinsurance and index insurance.

Insurance is a risk management tool that generally works by pooling risks. Spreading the risk over a greater number of people and delinking payment for services from the time when services are needed to a time when they are not limits the risks and consequences of catastrophic spending for the individual. Risk pooling thereby helps to transfer the payment from a person that has fallen on hard times to the well-off group in the population and from a period when a person is well off to a period when financial help is needed.

The price of insurance for the customer is generally calculated by taking the probability of a payout times the payout size. On top of this number there is a premium, which translates to the amount of money that the customer is ready to pay in order to avoid the risk, alternatively what the insurance company needs to charge in order to provide the service.

There are two main problems that insurance companies face when they are designing their products, adverse selection and moral hazard. Both problems are the result of asymmetric information, and both are important to understand in order to study the implementation problems of microinsurance.

Adverse Selection

Insurance is more pertinent for people who are more exposed to the covered risks. Therefore, more exposed people will also be more inclined to sign up for insurance coverage. If this likelihood is not taken into account by the insurer, it can lead to a pool of insured people that are not representative of the general population. For example, old people may be more inclined to buy health insurance than young people. From the insurance company's perspective this is of course not desirable. Usual ways of preventing the issue of adverse selection is either to limiting the coverage of the insurance or by not accepting persons with increased risks.

Moral hazard
The idea of moral hazard is based on the premise that people who are insured against risks change their behaviour and become more inclined to take the related risks. Or alternatively, the covered people may not minimize their exposure to these risks. For example, a person who has insured their car may be less careful when driving. Moral hazard is an inefficiency that arises as a result of information asymmetry. If insurance companies could perfectly observe their clients' actions, they could deny or increase the cost for clients who engage in risky behaviours.

There are two kinds of moral hazard, ex-ante and ex-post. Ex-ante moral hazard refers to change in behaviour before an accident occurs. For example, a person with health insurance who engages in risky activities such as extreme sports. Ex-post moral hazard describes how behaviour changes after the occurrence of an event. For example, a person who has been in a car accident might exaggerate the damage to the car in order to increase the payout.

Three mechanisms can be used to reduce moral hazard:
- Co-insurance, where the insured shares the loss with the insurer.
- Deductibles or excess, where the insured pays an amount of money when a claim is made irrespective of co-insurance.
- No-claims bonuses, which means that the insurance premium is reduced in relation to the number of years in which no claims are made.

In chapter 3.9, it will be explained how both moral hazard and adverse selection can be minimized with index insurance schemes.

3.5 Defining microinsurance

Microinsurance is the protection of low-income people by the means of risk pooling. The definition of microinsurance is exactly the same as the definition for regular insurance with the additional requirement that the target market is poor people. How poor the customers are depends on the situation, but the main distinction of microinsurance is that it targets the part of the population who have not previously had the possibility of obtaining insurance. Given this distinction, microinsurance generally differs from regular insurance when it comes to the types of risks, delivery channels, premium levels and types of claim requirements.

There are many misconceptions about what microinsurance is, and it should therefore be emphasized what is not included in the definition of microinsurance. Microinsurance is not an insurance provided by small insurance companies. In fact, many microinsurance schemes around the world are provided by big institutions, such as the German Allianz group with more than 85 million customers worldwide (Allianz SE, 2015). Neither is microinsurance just another product offered by microfinance institutions. Although microinsurance is often offered together with other forms of microfinance, this is due to the effectiveness of using the same channels and is not a requirement of microinsurance. Another misconception is that microinsurance is regular insurance with smaller sums insured or smaller premiums. This is not true. Many forms of microinsurance protect against great costs, such as big losses of harvest, and premiums can often be comparatively high. With that said it is often a focus of microinsurance providers to keep premiums low due to the cost-sensitive target market.

Microinsurance is a concept that is still being tested and experimented with around the world. Thus, its methods and practices are constantly changing. Still, if we look at how microinsurance is being implemented in general, we can find a few key aspects in which it differs from regular insurance.

One of the most defining aspects of microinsurance is the product design. There is generally an extensive focus on simplicity and accessibility. For example, companies who offer microinsurance often

try to avoid complicated application procedures and contracts that are difficult to understand. According to a survey of companies with commercial interest in microinsurance, the main challenge they face is the unfamiliarity with insurance concepts among low-income people. Other significant challenges are lack of education, problems with the distribution network, high level of costs, local regulations, adverse selection and lack of data about the market (Croydon, Molitor, & Ranganathan, 2013).

The problems with distribution networks refers to the problem of reaching the customers. They are often rural farmers who live in places that can be difficult to reach by road or badly mapped. Often, there are no registers of who lives where and there are no means of contacting other than in person. To tackle this problem microinsurance providers often sell their products together with other products or programmes that the potential customers come in contact with, such as seed or fertilizer retailers, mobile carriers, unions or other microfinance institutions.

Another way that microinsurance often differs from regular insurance is the types of risks they cover. This is partly due to the fact that poor people are exposed to different kinds of risks than traditional insurance customers, but it also has to do with costs. In order to sell microinsurance the companies need to have a heavy focus on cost reduction. This means that the types of risks covered need to be easily administered, cost-effective in distribution and claiming and justify low premiums. The most common types of microinsurance are life insurance and funeral insurance, which are generally seen as risks that are easy to monitor. In recent years microinsurance companies have started to make greater use of technology and innovative product design in order to be able to offer more complex products, such as health insurance and agriculture insurance (for example cover against low rainfall levels) (Münchener Rückversicherungs-Gesellschaft, Consultative Group to Assist the Poorest, & International Labour Office, 2012). Index insurance is an example of this, which is explained in chapter 3.9.

Lastly, microinsurance differs from regular insurance in who provides it. Regular insurance is typically provided by private businesses. As already mentioned, microinsurance is a growing and continuously evolving idea. It is currently offered by a variety of providers, such as private companies, religious groups, development aid agencies, NGOs, governments and any combination of these. Governments have actually been a great contributor to the growth of microinsurance, due to their interest in providing social protection for their citizens. They can work as providers of the insurance, but also often play a role in stimulating the market through monetary or other types of support. For example, the President of Colombia has promoted microinsurance on national television and in the Philippines the Government sponsors a “microinsurance Month” each year (Münchener Rückversicherungs-Gesellschaft et al., 2012). The potential of microinsurance to work as a form of development aid is still being debated.

3.6 Microinsurance as a form of aid

In the field of development economics, one of the most defining books is *Development Economics* by Debraj Ray. The book contains the theory behind the concept of microinsurance, and concludes that weather insurances have been shown not to have a substantially positive effect on the farmers’ wealth. This is because farmers often have self-insurance against weather risk in the form of livestock that is easy to sell on the local market in times of economic distress (Ray, 1998).

On the other side of the argument, Brigit Helms debates in CGAP’s book *Access for All* that the potential for microfinance is enormous. She says that although microfinance cannot solve all the problems caused by poverty, they can put power and resources in the hands of the poor, letting them chart their own paths out of poverty (Helms & Consultative Group to Assist the Poorest, 2006).

Regardless, the fact is that microinsurance has become an increasingly popular form of development work around the world. And with new technology aiding in distribution and management, insurances and other financial services are becoming increasingly effective. Craig Churchill argues in The World Bank's *The New Microfinance Handbook* that microinsurance has been a successful venture, but it still needs to mature as a product (World Bank, 2013). There is especially a concern for the low levels of insurance literacy, meaning that it's difficult for clients to understand policies and use them properly. Aside from that there are concerns about the efficiency of the programmes and the problem of gathering meaningful data in the low-income market segment.

3.7 Benefits of microinsurance

The positive effects of microinsurance can be grouped into many categories. This section starts by looking at the benefits to the recipients such as financial protection and access to financial services. It then goes on to benefits for the community or country, meaning the economic growth that may come as a result of a developing insurance industry.

The most obvious benefit of microinsurance is the financial protection that it creates for the poor. As mentioned earlier, poverty is both the problem of low incomes and of uncertain incomes. Through providing money to the insured in times of need, situations can be directly improved and lives can be saved.

A second benefit is the improved access to financial services that microinsurance provides. To compensate for the lack of formal financial services, poor people become experts at juggling informal financial contracts. These contracts can include loans from neighbours and friends, shopkeeper credit, remittances to and from family members, savings in cash, rent arrears, wage advances and loans to others. These coping mechanisms are not necessarily negative, but informal financial contracts are widely regarded as more inefficient than formal ones. They can also have long-term negative effects on the household and the community, for example if income shocks are managed by depleting savings, selling income-generating possessions, borrowing at high interest rates, foregoing medical care or withdrawing children from school.

In developed countries insurance industries have been under development under a long time. They have a history that started among friendly societies in the retail and manufacturing companies and have since matured into the industry it is today (Münchener Rückversicherungs-Gesellschaft et al., 2012). Many developing countries today lack a foundation for an insurance industry to take hold and microinsurance can provide an opportunity for these countries to build an insurance industry from the ground up.

Development of the insurance industry has been shown to have a positive effect on national economic development. A study of 56 countries over the 1976-2004 period found that both life and non-life insurance has a positive effect on economic growth (Arena, 2006). In another study economists Haiss and Sumegi argue that the insurance industry should be paid more attention by financial sector analysts and policy makers, based on the find that among 29 European countries life insurance had a positive impact on GDP growth between 1992 and 2005. Doctor Leal Brainard argues that this effect is also true for lower and middle income countries, although there is a lack of reliable data at the moment (Brainard, 2008)

A development of an insurance industry may impact the national growth in a number of different ways:

- **By reducing the risk businesses take on.**
  Insurance can either directly reduce the businesses' risks through payouts in times of need or indirectly by promoting risk reduction measures.

- **By stimulating access to credit.**
  A company that is insured against certain types of losses is more likely to be approved for a loan by a bank, or will be able to borrow money at a lower interest rate. This leads to greater investment levels and in turn greater economic development.

- **By facilitating investments in higher-risk higher-return activities.**
  Being insured gives the customer more freedom to take economic risks without worrying about the repercussions. Risk-taking can sometimes be detrimental to society, but it can also lead to efficiency gains. For example, a farmer might avoid growing a certain type of crop with a high yield because it is sensitive to low rainfall, although the farmer and society would be better off in the long run if the farmer was able to invest in the crop.

- **By stimulating development of debt and equity markets.**
  Since insurance companies are interested in hedging the risk they take on, they create a demand for financial products. A well-developed insurance industry may thereby improve the general efficiency of the economy by creating liquidity and lowering transaction costs. Insurance companies may also create new financial products of interest to other sectors of the economy.

Damian Ward and Ralf Zurbruegg studied the relationship between an insurance industry and economic growth and found that while insurance has a positive impact on growth in some countries, the reverse is true in other countries (Ward & Zurbruegg, 2000). The relationship seems to be country-specific and dependent on a number of different national circumstances. However, Kugler and Reza Ofoghi argue that Ward and Zurbruegg's results were affected by the so called aggregation problem. They used cointegration analysis and causality tests and showed that for most cases, there is a long run relationship between insurance market size and economic growth (Kugler & Ofoghi, 2005).

If Ward and Zurbruegg are right, it is relevant to look at how insurance and growth interact in the area where the present study was performed, which is Zambia. Akinlo and Apanisile used Pooled OLS, the Fixed Effect Model and the Generalized Method of Moment Panel Model to show that insurance has a positive and significant impact on economic growth in sub-Saharan Africa (Akinlo & Apanisile, 2014). According to the study, a well-developed insurance sector contributes to economic development by providing long-term investments and strengthening risk-taking abilities.

3.8 Challenges of microinsurance

There are many challenges facing providers of microinsurance today. This section outlines the factors identified by insurance providers as the main obstacles to implementing microinsurance schemes across the world. The different factors are often connected and regularly stem from problems with the distribution networks and lack of data.

In a survey of 24 organizations that supply microinsurance, the high level of costs was identified as the single biggest challenge for the microinsurance markets (Microinsurance Network, 2011). The high costs are mainly due to high acquisition costs, as customers often live in remote areas and are costly to reach. Contracts are often for small amounts and damage assessments have to be done on an individual basis. Combined with low premiums due to the high price sensitivity of the target customers, high costs lead to low levels of profits. As a result, private companies shy away from the market and leave behind state-subsidized or state-owned companies. Many argue that these companies are less effective, leading in the end to bad products for the policy holders and unnecessary costs to taxpayers.

In recent years, insurance products and the supply chains of microinsurance have seen huge development and profitability within the sector has increased vastly. According to a 2013 survey of 37 insurance companies, microinsurance revenue had risen by 54 percent per year on average during the previous five years (Croydon et al., 2013).

Just as with regular insurance, two big challenges for microinsurance are moral hazard and adverse selection. Moral hazard refers to the risk that insured customers become more likely to engage in risky behavior. Adverse selection on the other hand, means that people in riskier situation are more likely to purchase insurance. In other words, the actual customers do not have the same habits as the sample that the cost calculations are based on. There are many examples of this happening, for instance a study in 1999 found that women who were pregnant or about to become pregnant had a significantly higher probability of joining a health insurance scheme set up in Zaire. (Criel, Van der Stuyft, & Van Lerberghe, 1999)

Moral hazard and adverse selection are both problems of information asymmetry, and such problems can become even harder to deal with when it comes to microinsurance compared to regular insurance. The reason for this is mainly the lack of reliable data about the target customers. If the insurance company is limited by lack of actuarial data when they design their products they are either forced to be conservative and set their prices high or to attempt a "trial and error" approach, which is risky and can become costly if prices are set at the wrong level. In chapter 3.9 it is explained how information asymmetry can be addressed by using index insurance.

Lack of insurance awareness among the poor population is often seen as an obstacle to insurance providers. The lack of awareness is often explained by either low education levels or a tradition of dealing with risks in other manners. Low insurance literacy can lead to both lower demand for the products and higher acquisition costs, as the companies need to educate customers about insurance in order to sell it. Many also argue that insurance products often have a bad reputation among poor people. Stories about long delays, benefits not being paid and other prejudices are easily spread by word of mouth and lead to an even lower demand (Microinsurance Network, 2011).

There are some who argue that the problem of low insurance literacy is exaggerated. A study in 2003 researched why subscription rates had dropped for a community health insurance scheme in Guinea. The study found that contrary to popular belief, failure to understand the scheme did not explain the low coverage rates. The research subjects showed an accurate understanding of how the scheme worked. They were also able to explain the principles of health insurance and highly valued risk-pooling and its redistributive effects. They also found the premium of 2 USD to be fair. Instead, the study pointed to a problem of affordability and the poor quality of care that the scheme offered. (Criel & Waelkens, 2003)

3.9 Index insurance

To tackle the problem of the high levels of costs and the problem of providing microinsurance on a profitable basis, index insurance was invented. The idea is that the payouts are based on a predetermined index, for example temperature or amount of rainfall. This makes the assessing and settlement processes quicker, more objective and less costly. It also allows for significant scaling benefits, as the marginal cost of each issued insurance is small compared to that of traditional insurance.

The idea of index insurance is often attributed to the Indian economist Chakravarti who in 1920 pictured a rainfall insurance which gave a payout to customers in the case of rainfall below a threshold (Chakravati, 1920). Today's index insurances work by the same principles, although they have become increasingly advanced. They are often tailor made to reflect the different stages of agricultural growth

cycle with different thresholds at different times of the season, as well as thresholds for both for too little and too much rain.

The most popular type of index insurance is weather insurance against bad crop yields. The index can in this case be established in the form of temperature or rainfall levels, which can be monitored with satellites or weather stations. The reason why weather insurances are a popular form of index insurance is partly because weather is easy to monitor and partly because weather is strongly correlated between nearby farms and is therefore something that is hard for farmers to arrange mutual insurance against. Other examples of index insurance are area-yield index insurance, which is based on the realized average harvest yield of an area, and livestock index insurance, which is used to protect farmers against livestock losses caused by unusually cold winters.

The index is based on historical data, and therefore requires a lot of data to be determined properly. Ideally, actuaries need at least 20 years of weather and yield data in order to price the product and decide the index. This type of data can be hard to find in many developing countries, partly because of insufficient monitoring and partly due to continuously changing yields.

The premiums of index insurances are low because the providers have no need of performing individual visits to farms in order to assess the situation, which can be especially costly in developing countries. The same principle applies when selling the product. To reduce the premiums even further, transaction cost can be minimized by selling the insurance through organizations that come in contact with farmers, such as banks, microfinance companies or export companies. In fact, a lot of index insurances are sold in packages together with micro-loans, which can be beneficial for the lender who wants to make sure that the loan can be repaid.

The two biggest challenges of traditional insurance are minimized when using index insurance. Moral hazard is the problem of insured customers engaging in risky behaviour. For example, a farmer might be less likely to apply the extra fertilizer, labour, and other inputs needed to maximize chances of success. This becomes irrelevant under an index insurance scheme, since insurance payouts are not linked to the actual output of the farm but are instead linked to the weather, a factor that the farmer has no control over.

The challenge of adverse selection is also minimized. Adverse selection arises since farmers in the riskiest situations are naturally the most eager to purchase insurance. Index insurance schemes are designed to deal with risks that affect the whole community with the same likelihood (such as rainfall irregularities), it doesn't matter which of the farmers choose to take part of the insurance. They are all exposed to the same amount of risk.

3.10 MicroEnsure

This section focuses on MicroEnsure, an organization that provides microinsurance for low-income people over the world, as well as their work with the Lima Credit Scheme in Zambia. The information and numbers are taken from interviews with employees at MicroEnsure.

MicroEnsure is an organization founded in 2002 by the American microfinance organization Opportunity International as a way to provide microinsurance for their existing loan clients. At first the products they worked with were life, funeral and property insurance, but they soon recognized the demand and opportunities of crop insurance. The first pilot test of weather index insurance was done on groundnut farmers in Malawi. In 2007 MicroEnsure received a multi-million dollar grant from the Bill & Melina Gates foundation, which enabled them to expand further. Today MicroEnsure is active in 14 countries and serves four million people, half of whom are in Africa. The company does not sell the product or bear the risk, but instead provide all other elements of the insurance projects, including

project management, product design, training of farmers, marketing, pricing and monitoring. MicroEnsure has operated in Zambia since 2013 and the local office is focusing on life insurances and weather index insurance.

The Zambian farming season stretches from November until March. During the 2013/2014 season MicroEnsure was working together with NWK, a company that both sells agricultural input and buys agricultural produce, primarily in the cotton sector. They covered around 7 000 cotton farmers with weather index insurance, along with an additional 25 000 farmers with life insurance.

The insurances are provided through a micro loan-programme that NWK organizes. The farmer gets inputs in the form of crops and fertilizer, and in return they agree to sell their whole harvest to NWK. When they receive the inputs the farmers have the chance to opt-in for the weather insurance. When the harvest is sold, NWK deducts the cost of inputs and insurance from the money returned.

The cost of the insurance is usually around 20 Kwacha (1.50 USD) per hectare. The payout is then dependent upon the severity of the draught and is counted as a percentage of 250 Kwacha (20 USD) per hectare. 250 Kwacha is supposed to be equivalent to the cost of inputs, i.e. crops and fertilizer. If the farmer wants to insure the whole yield of the farm, then a valuation of the yield is done and the cost of the insurance is usually calculated as 8 % of the covered value. In the weather index insurance provided by MicroEnsure there is also included a life insurance for the head of the family, with a possibility to opt-in for life insurance coverage for more than one family member.

The plan was to increase the number of weather index insurances from 7 000 to 25 000 for the 2014/2015 season, but a shift in management at NWK led to a change of plans. Instead, the number of covered farmers was reduced to 3 500 and the life insurance programme withdrawn, while further analysis of the collaboration is done. Meanwhile, MicroEnsure has found two new customers. The first one is Pioneer, the agriculture division of DuPont. They sell crops and fertilizers to maize farmers and have decided to try to sell MicroEnsure's weather index insurance in two districts, Mumbwa and Mpongwe. During the 2014/2015 season, MicroEnsure covered 500 of Pioneer's farmers.

The second new customer is Zambia National Farmers Union (ZNFU), a farmer's organization that has a micro loan-programme called the Lima Credit Scheme. The programme provides farmers with inputs in the form of crops and fertilizer. The farmers are free to sell their harvest to whomever they want, but are required to pay back the cost of inputs once they have sold their harvest. In the programme they have included a free rainfall insurance that is organized by ZISC. ZISC's insurance is not an index insurance but an individual insurance and is therefore more costly. This season, ZNFU has agreed to try MicroEnsures insurance on maize and soybean farmers in three out of the organizations 89 districts. Around 2000 of ZNFU's farmers are covered by MicroEnsure during the 2014/2015 season. ZNFU insisted that MicroEnsure create a product where the cost is calculated as 4 percent of the covered value, instead of the usual 8 percent. This means that the cost of the insurance is lower while the chances of getting a payout are smaller.

During their first years in Zambia, MicroEnsure will get funding from the International Finance Corporation (IFC) in order to meet the costs. The intention is that as more and more farmers are covered by MicroEnsure the project will become financially stable on its own and the funding from the IFC stop.

The IFC is an international financial institution that is focused on financing and giving advice to development projects done in the private sector in developing countries. The funding for MicroEnsure's project is administered by the IFC but the funds come from GIIF, which is a multi-donor trust fund that is solely focused on index insurances. GIIF is funded by the European Union, Japan and the Netherlands.

4 Literature review and theory

This chapter examines the findings of previous research on the relationship between insurance and investments. The chapter is divided into three parts. The first part investigates the direct impact that microinsurance has on investment levels, concluding that most empirical studies have found a positive relationship. The second part explains the concept of poverty traps and how they may explain how insurance can increase the productivity of farmers by hindering the loss of certain assets. In the last part, a theoretical model is introduced, explaining the mechanisms behind a farmer choosing to increase investments.

4.1 Impact on investments

A 2012 study researched the investment habits among Ghanaian farmers. It found that demand for index insurance was strong and that farmers who were given the opportunity of purchasing rainfall index insurance made significantly larger investments on their farms. The study also found that demand for insurance was strongly correlated with whether the farmer had received an insurance payout in previous years as well as recent poor rain in the village (Karlan et al., 2012). The main two explanations for this effect are unlocking of credit access for farmers and the so-called peace-of-mind effect.

Unlocking credit access means that lenders are more motivated to provide credit to farmers when they don't have to worry about certain risks (such as draught, excess rain or livestock death). This means that the farmer gets access to more productive inputs and for a lower price. In practice, lenders are also helped by the information about the farmers that a microinsurance scheme provides. This is one reason why microcredit and microinsurance programmes are often done in collaboration or as one programme, such as the Lima Credit Scheme. A study of poor Ethiopian households supports the link between managing risk and accessing credit by showing that households that have less ability to manage income risks are also less likely to buy fertilizer on credit (Dercon & Christiaensen, 2008).

The peace-of-mind effect means that the insured individual is less compelled to set aside unproductive funds in some sort of saving and instead putting the funds into investments. Microinsurance is also believed to encourage households to allocate recourses to more profitable ends which would otherwise be dismissed for being too risky (Morduch, 1995). This means not only taking funds away from savings, but also putting the funds into higher-risk, higher-return assets (Münchener Rückversicherungs-Gesellschaft, Consultative Group to Assist the Poorest, & International Labour Office, 2006). For example, a farmer may be more compelled to invest in a tractor when the financial repercussions of breaking it are mitigated.

The positive relationship between insurance and risk-taking was confirmed in a study by Mushfiq Mobarak and Mark Rosenzweig. While researching demand for, and effects of, rainfall index insurance in India they found that both informal and formal index insurance increased risk-taking (Mobarak & Rosenzweig, 2012). In particular, insured rice farmers became more likely to plant rice varieties that gave higher yield but were less draught resistant. A related study found consistent results by studying increases in sow-raising among insured farmers in China (Cai et al., 2014).

There may be an issue of higher educated individuals being both more likely to buy insurance and to invest in order to increase yields. In 2014, a study performed a randomized controlled trial of Indian farmers in order to study how insurance affected their entrepreneurial activity and risk-taking. It found that insured farmers substituted investments toward cash crops that give higher return but are more sensitive to rainfall (Cole et al., 2014). The study also found that this effect was highly concentrated among farmers with higher education. For this reason, the results of the present study were controlled for education levels.

There are also ways that microinsurance may decrease investments among the insured. This is connected to the idea of the peace-of-mind effect and works in a similar manner. The idea is that an insured household may be compelled to move funds away from holding assets, but instead of putting the funds into investments they are put into consumption. This can be especially devastating when the original assets were income-generating, such as livestock.

One study that has found evidence against insurance leading to increased investments is a 2009 study in Malawi that gave two groups of farmers different financing options (Giné & Yang, 2009). One of the groups got a regular loan and the other group got a loan that was insured against certain types of losses. They found that the group with the regular loan had higher take-up than the group that was offered insurance. This was explained by the fact that the farmers were already implicitly insured by a limited liability clause in the loan contract. They also argued that demand for weather insurance must also be viewed from the perspective of the lender, which means that microinsurance may be a convenient way of increasing investments even if demand among farmers is low. Giné and Yang also found that take-up of the insured loan was heavily correlated with education level, income and wealth of the farmers.

4.2 Poverty traps

A poverty trap is defined as "any self-reinforcing mechanism which causes poverty to persist." (Azariadis & Stachurski, 2005). Poverty traps are factors that have inhibitory effects on the households' ability to accumulate wealth. This leads to vicious circles of poverty which are often persistent across generations. Examples of poverty traps are lack of education, malnutrition, lack of infrastructure, costly coping mechanisms to income shocks and a general lack of productive assets.

Poverty traps imply that there are critical thresholds or "tipping points". If assets owned by a poor household fall under this threshold they will find it difficult to accumulate assets again, thus being trapped in poverty. If these thresholds exist, it means that income shocks do not only have temporary effects but can also have permanent consequences, resulting in a loss of long-term productivity for both the individual and the community.

Frederick Zimmerman and Michael Carter studied how households responded to income shocks depending on their amount of assets. They found that households above a certain threshold tend to focus on consumption smoothing, for example selling livestock in order to preserve consumption (Zimmerman & Carter, 2003). Poorer households around the threshold tended to focus on asset smoothing, holding on to their livestock at the cost of consumption. This supports the idea of thresholds or "tipping points" and further explains how household on opposite sides of the threshold react to income shocks.

A study of a microinsurance payout in Kenya during a draught in 2011 found that insured households were 22-36 percentage points less likely to draw down on assets during the draught (Janzen & Carter, 2013). This effect was especially large among livestock-rich households. Insured households were also 27-36 percentage points less likely to reduce meals than uninsured households. Drawing down on meals was more prevalent among livestock-poor households.

John Hoddinott argues that the distinction between asset and consumption smoothing is actually a distinction between what kind of capital households draw down on (Hoddinott, 2006). The different kinds of capital can be physical, financial, social or human. Asset smoothing, Hoddinott argues, is actually at the cost of human capital, which leads to losses in child health and nutrition. It is widely known that malnutrition of children can have long term consequences both for the child's quality of life and their capacity to do productive work. Asset smoothing can thus often lead to a nutrition-based

poverty trap. A second type of human capital is education, another factor that has long-term impact on people's quality of life and productivity, in turn leading to an education-based poverty trap. Further support for Hoddinotts theories have come from a study that found evidence of asset smoothing by poor people in Ethiopia (Carter, Little, Mogues, & Negatu, 2007), and again from Michael Carter who together with Travis Lybbert estimated an asset threshold among farmers in Burkina Faso (Carter & Lybbert, 2012).

The theory of poverty traps suggest that microinsurance may support the productivity of a community by hindering the loss of productive assets rather than by enabling new investments. Recent literature on microinsurance has focused on detecting poverty traps and studying how to prevent poor people from falling into them.

4.3 Theoretical model

In order to model a typical farmer's decisions and understand how his or her spending changes in relation to weather index insurance we use a two-period model. The two periods symbolize two farming seasons.

First, we assume that the farmer's spending in the two periods can only be allocated between consumption and investments. Total spending is limited by the period's income and we can assume that the income is utilized to its full potential.

$$F_1 = c_1 + i_1$$
$$F_2 = c_2 + i_2$$

F_i is the total income in period i. c_i and i_i are the amount of money put into consumption and investments respectively. F_1 is given and F_2 is dependent on i_1.

The farmer's goal is to maximize his expected utility over the two periods. The farmer's utility is dependent on consumption and increasing, meaning that the first derivative of the utility function is always positive. Utility in period 2 is discounted by a given factor δ, which is a number between 0 and 1.

$$Max\ E[U] = Max\ E[u(c_1) + \delta u(c_2)] = Max\ E[u(c_1)] + \delta * E[u(c_2)]$$

$$\frac{du}{dc} > 0$$

We also assume that the second derivative of the utility function is always negative, which has the interpretation that the farmer is risk averse. This is concurring with how farmers behave, for example that farmers prefer two moderate years to one great year and one poorer year (Yesuf & Bluffstone, 2009).

$$\frac{d^2u}{dc^2} < 0$$

$$u(E[c]) \geq E[u(c)]$$

We have two different farmers, farmer A and farmer B. Farmer A has chosen to take part of an insurance programme, while farmer B has chosen not to.

The income in period one (F_1) is given, but the income in period two (F_2) is dependent on the amount of investments made in period 1 (i_1) as well as a stochastic variable, which symbolizes weather. This stochastic variable is denoted Z and to simplify the model it has only two possible states, bad and good. The income should increase with the amount of investments made in the previous period.

$$F_{2A} = f(i_{1A}, Z) + g(Z) - k$$

$$F_{2B} = f(i_{1B}, Z)$$

$$Z \sim \{bad, good\}$$

$$f(i_1, bad) < f(i_1, good)$$

$$\frac{df}{di_1} > 0$$

Here, g(Z) denotes the payout from the insurance company, which depends on the weather variable, and k is a positive number that represents the cost of the insurance, which is paid in period two for simplicity's sake. We assume that the payout is given when variable Z has a bad turnout, and the payout in this case is exactly the difference between a good year and a bad year. This is reasonable, since the goal of weather insurance is to completely offset the economic loss of a bad year.

$$g(Z) \sim \{f(i_1, good) - f(i_1, bad), 0\}$$

We assume that the price of the insurance is actuarially fair and thereby equal to the expected payout. For now, we assume that there is no insurance premium.

$$k = E[g(Z)] = p_{bad} * \big(f(i_1, good) - f(i_1, bad)\big)$$

Here, p_{bad} is the probability of a bad year. We can then calculate and simplify the possible states of the incomes in period 2.

$$\begin{aligned} F_{2A} &\sim \{f(i_{1A}, bad) + f(i_{1A}, good) - f(i_{1A}, bad), f(i_{1A}, good) + 0\} - k \\ &= \{f(i_{1A}, good), f(i_{1A}, good)\} - p_{bad} * \big(f(i_1, good) - f(i_1, bad)\big) \\ &= f(i_{1A}, good) - p_{bad} * \big(f(i_{1A}, good) - f(i_{1A}, bad)\big) \end{aligned}$$

$$F_{2B} \sim \{f(i_{1B}, bad), f(i_{1B}, good)\}$$

Now we want to determine how the two farmers spending on investments differ. In other words, we want to calculate the difference between i_{1A} and i_{1B}.

Since there is no advantage to investing in the second period, we can easily see that i_2 is 0 for both farmers. This means that the following holds:

$$c_{2A} = F_{2A} = f(i_{1A}, good) - p_{bad} * \big(f(i_{1A}, good) - f(i_{1A}, bad)\big)$$

$$c_{2B} = F_{2B} \sim \{f(i_{1B}, bad), f(i_{1B}, good)\}$$

First, we study the objective function of farmer A.

$$Max\ E[U_A] = Max\ E[u(c_{1A}) + \delta u(c_{2A})] = Max\ E[u(c_{1A})] + \delta * E[u(c_{2A})]$$

$$= Max\ u(c_{1A}) + \delta * u\Big(f(i_{1A}, good) - p_{bad} * \big(f(i_{1A}, good) - f(i_{1A}, bad)\big)\Big)$$

Then, we study the objective function of farmer B.

$$\begin{aligned} Max\ E[U_B] &= Max\ E[u(c_{1B})] + \delta * E[u(c_{2B})] \\ &= Max\ u(c_{1B}) + \delta * E[u(F_{2B})] \end{aligned}$$

The key is to compare the objective functions. We can see that for both farmers, c_1 increases utility in the first year while i_1 increases utility in the second year. The difference is how much utility in the second year increases with i_1. If we can show that $E[u(c_{2A})]$ is bigger than $E[u(c_{2B})]$, then we can conclude that i_{1A} is also bigger than i_{1B}. To prove this, we can use the fact that the farmers are risk averse.

$$\begin{aligned} E[u(F_{2B})] < u(E[F_{2B}]) &= u\big(p_{bad} * f(i_{1B}, bad) + (1 - p_{bad}) * f(i_{1B}, good)\big) \\ &= u\Big(f(i_{1B}, good) - p_{bad} * \big(f(i_{1B}, good) - f(i_{1B}, bad)\big)\Big) \end{aligned}$$

This proves that investments in period one is more efficient for farmer A than for farmer B. Thus, in our model, an insured farmer will allocate more money into investments.

There are some limitations of our model. Firstly, the farmers in the model are not given the option of saving money from period one until period two. This could be a problem, since saving provides the farmer with another way of smoothing incomes and increasing total utility. Although we can argue that the saving options for poor farmers are limited. Most farmers have no access to savings accounts and keeping cash at home involves great risks. Instead many farmers have large portions of their assets fixed in property such as livestock, which can often be used on the farm and seen as a form of investment.

A second limitation of our model is that we assume that there is no insurance premium. Looking back at the calculations, it can be seen that as long as $u(c_{2A})$ is bigger than $E[u(c_{2B})]$ the conclusion holds. This is the same as saying that the premium of the insurance must be lower than what the farmer is prepared to pay to eliminate the risk. This must by definition be true in order for the farmer to accept the insurance. Thereby, the model still holds as long as the premium is at a reasonable level.

5 Methodology

This chapter aims to explain how the study was performed, what questions the survey consisted of and how the correlation tests were performed.

5.1 Participants

The study was performed by distributing a survey to farmers in and around the town of Choma in southern Zambia. A portion of the surveys where given to farmers who came to Choma in order to buy fertilizer for the 2014/2015 farming season. Another portion of the surveys were given to farmers who for some reason were in contact with their union at the ZNFU office in Choma. In total, 49 farmers responded to the survey. Out of these, 86 percent were male and 14 percent female. The average age among the farmers was 44.

5.2 Format of the survey

The survey consisted of 28 questions divided into three parts; "The household and the farm", "Insurance" and "Risk taking and investments". The full survey is included in appendix number 2. Since the aim of the study was to investigate the investment habits of farmers with and without insurance, many of the questions were about differences between this season and last season.

The first questions aimed to get an understanding of the living situation of the farmer. These questions included age, gender and marital status. There were also questions about the size of the farm and whether the farmer had bought or sold any land in the last year. This was asked to find the farmers who had made the biggest investments during the last year, in order to research if there was any correlation between investing in land and taking part in insurance. After this came questions about which crops were grown on the farm and what types of livestock the farmer had. Both of these questions asked both for the current season (2014/2015) and last season (2013/2015), in order to be able to compare the numbers.

In the second part of the survey, questions about insurance were asked. These questions were separated into two pages, one for the current farming season (2014/2015) and one for the previous farming season (2013/2014). First, the farmers were asked if they took part in the Lima Credit Scheme. As explained in chapter 3.10, the Lima Credit Scheme is an initiative by the Zambia National Farmers' Union where small-scale farmers get seeds and fertilizer at the beginning of the season in exchange for a portion of the income when the harvest is sold. Included in this programme is also a weather insurance. One purpose of this question was to investigate how many farmers were aware of the included insurance. The second question on the "Insurance" part was about whether the farmer had any insurance cover at all, and if they did, what types of insurance they had.

The third part of the survey contained questions about risk taking and investments. Almost all questions had two parts, one for the current season (2014/2015) and one for last season (2013/2015). The farmers were asked about whether they had used a tractor or draft animal power on their land, how much they had paid for chemicals such as fertilizer, how much they had paid for hired labour and what farming tools they owned. This part also included a question that said "Compared to others, are you willing to take risks on your farm?" This question was inspired by a question asked by Dean Karlan and his colleagues during their research in Ghana (Karlan et al., 2012).

5.3 Test variables

The answers from the survey were used to perform analysis about the correlation between being insured and investment habits. The hypothesis was that farmers who had rainfall insurance would be more likely to make investments.

Ten different measures of investments and risk-taking were used:

1. Change of the size of land in the last year.
2. Percentage change of the size of land in the last year.
3. Change of number of crops in the last year.
4. Change of number of animals in the last year.
5. Change of the *weighted livestock index* in the last year.
6. Change of cost of chemicals such as fertilizer and weed-killer.
7. Change of cost of hired labour on farm.
8. Willing to take risks on farm.
9. Change of number of tools owned in the last year.
10. Change of *weighted tool index* in the last year.

The *weighted livestock index* was calculated by multiplying the number of animals owned for each animal with the inverse of the "average non-zero" number for the respective animal during the 2014/2015 season. The products were then added together for each farmer. The "average non-zero" number was calculated by taking the average number of animals among the farmers who had at least one of the particular animal.

$$weighted\ livestock\ index\ of\ farmer = \sum_{i=kind\ of\ animal} \frac{number\ of\ i\ owned\ by\ farmer}{average\ nonzero\ for\ i}$$

The reasoning behind calculating this number was to simplify comparison between farmers. Since a pig is a bigger investment than a chicken, it could be considered misleading to give the two animals equal weight. The animals were therefore multiplied with an assigned weight before they were added together. The inverses of the "average non-zero" numbers were chosen as weights since they indicate how many animals a typical farmer has. For example, the average non-zero value for pigs was 8.1 and the average non-zero value for local chickens was 27.4. Therefore, pigs was assumed to be a 3.38 times bigger investment than a local chicken.

The *weighted tool index* was calculated by representing each tool with the inverse of the fraction of farmers who own the tool. For each farmer, the representative numbers for the tools that they owned were then added together.

$$weighted\ tool\ index\ of\ farmer = \sum_{i=tool} 1_{farmer\ owns\ i} * \frac{total\ number\ of\ farmers}{number\ of\ farmers\ who\ own\ i}$$

The reasoning behind using the *weighted tool index* is the same as for the *weighted livestock index*. By assigning a weight to each tool we get a sense of how big of an investment each tool is depending on how common it is, thereby giving a fairer view of how big investments the farmer has made in the last year. As an example, for the 2014/2015 season a hoe was assigned the weight 1.2 while a water pump was assigned the weight 4.9. Therefore a water pump was assumed to be a 4.08 times bigger investment than a hoe.

Data about the farmers' use of tractors and animal draft power on their farms was not included in the correlation analysis. The reason for this is that there was no change in use of tractors or animals since the year before among the surveyed farmers.

These ten measures were then tested against participation in the Lima Credit Scheme during the 2013/2014 season and having any insurance during the 2013/2014 season. Moreover, measures of education level, gender, marriage status and age were also included in the analysis in order to test if the correlations could be explained by any other phenomenon. Squared age was also included in the analysis. However, it was left out of the tables in the next chapter since it had no impact on the results.

Education level is measured as a dummy variable, where 0 symbolizes primary education and 1 stands for further education such as secondary or university. For the gender measure 0 means male and 1 means female. Lastly, marriage status is indicated as 0 for not married and 1 for married.

6 Results

The results of the regression tests are as follows:

	Change of land size				Percentage change of land size			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Lima Credit Scheme 13/14	0,075	-0,715	-0,900	-0,904	0,044	-0,004	-0,034	-0,046
	[1,251]	[1,276]	[1,297]	[1,337]	[0,077]	[0,079]	[0,076]	[0,075]
Insurance 13/14		**3,047***	**3,252****	**3,211***		**0,188***	**0,220****	**0,212****
		[1,526]	[1,548]	[1,633]		[0,094]	[0,091]	[0,091]
Education level			-1,116	-1,140			**-0,177****	**-0,199****
			[1,284]	[1,333]			[0,075]	[0,075]
Gender				-1,049				-0,130
				[1,891]				[0,106]
Married				-0,554				**-0,245****
				[2,153]				[0,121]
Age				-0,034				-0,001
				[0,053]				[0,003]
Adjusted R^2	-0,021	0,040	0,035	-0,016	-0,014	0,047	0,133	0,166
Observations	49	49	49	49	49	49	49	49

	Change of number of crops				Change of number of animals			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Lima Credit Scheme 13/14	0,249	0,086	0,116	0,110	6,554	5,328	2,657	2,062
	[0,263]	[0,269]	[0,274]	[0,285]	[13,314]	[14,144]	[14,294]	[14,583]
Insurance 13/14		**0,628***	**0,595***	**0,589***		4,728	7,678	11,002
		[0,321]	[0,327]	[0,348]		[16,917]	[17,063]	[17,817]
Education level			0,181	0,171			-16,061	-17,037
			[0,271]	[0,284]			[14,148]	[14,540]
Gender				-0,031				18,252
				[0,403]				[20,632]
Married				-0,085				-14,466
				[0,459]				[23,490]
Age				0,001				0,143
				[0,011]				[0,581]
Adjusted R^2	-0,002	0,055	0,043	-0,024	-0,016	-0,036	-0,030	-0,061
Observations	49	49	49	49	49	49	49	49

	Change of weighted livestock index				Change of cost of chemicals			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Lima Credit Scheme 13/14	0,748	0,750	0,674	0,660	2,764	2,879	2,628	2,506
	[0,647]	[0,688]	[0,702]	[0,713]	[2,522]	[2,681]	[2,739]	[2,801]
Insurance 13/14		-0,005	0,078	0,317		-0,445	-0,167	-0,624
		[0,823]	[0,838]	[0,871]		[3,207]	[3,269]	[3,422]
Education level			-0,454	-0,484			-1,511	-1,636
			[0,695]	[0,711]			[2,710]	[2,793]
Gender				1,093				0,208
				[1,009]				[3,963]
Married				-0,732				0,646
				[1,148]				[4,511]
Age				-0,004				0,133
				[0,028]				[0,112]
Adjusted R^2	0,007	-0,015	-0,027	-0,049	0,004	-0,017	-0,033	-0,070
Observations	49	49	49	49	49	49	49	49

	Change of cost of labourers				Willing to take risks			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Lima Credit Scheme 13/14	0,261	0,363	0,300	0,236	-0,065	-0,111	-0,123	-0,143
	[0,373]	[0,393]	[0,399]	[0,402]	[0,146]	[0,153]	[0,157]	[0,152]
Insurance 13/14		-0,394	-0,324	-0,371		0,178	0,191	0,252
		[0,470]	[0,476]	[0,491]		[0,183]	[0,187]	[0,185]
Education level			-0,380	-0,483			-0,073	-0,108
			[0,395]	[0,401]			[0,155]	[0,151]
Gender				-0,412				0,146
				[0,569]				[0,215]
Married				-1,023				**-0,529****
				[0,647]				[0,244]
Age				0,005				-0,004
				[0,016]				[0,006]
Adjusted R^2	-0,011	-0,017	-0,019	-0,024	-0,017	-0,018	-0,036	0,039
Observations	49	49	49	49	49	49	49	49

	Change of number of tools				Change of weighted tool index			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Lima Credit Scheme 13/14	-0,094	0,055	0,152	0,143	1,128	1,565	2,198	2,167
	[0,334]	[0,348]	[0,345]	[0,359]	[1,905]	[2,015]	[1,984]	[2,042]
Insurance 13/14		-0,573	-0,680	-0,706		-1,686	-2,386	-2,352
		[0,416]	[0,412]	[0,438]		[2,410]	[2,368]	[2,495]
Education level			**0,583***	0,570			**3,808***	**3,723***
			[0,342]	[0,358]			[1,964]	[2,036]
Gender				-0,149				-1,369
				[0,508]				[2,889]
Married				-0,094				-1,595
				[0,578]				[3,289]
Age				0,001				-0,059
				[0,014]				[0,081]
Adjusted R^2	-0,020	0,000	0,039	-0,027	-0,014	-0,025	0,033	-0,014
Observations	49	49	49	49	49	49	49	49

* Significant at the 90 %-level
** Significant at the 95 %-level

Note: Standard errors are provided in parentheses.

7 Discussion

In this chapter, the results of the study will be discussed and related to the background and theory. The goal is to recognise which conclusions can be drawn from the results as well as to identify what needs to be further investigated. First, limitations of the study are discussed in order to help the analysis. Then, the correlations are analysed one by one, as well as an overview of the rest of the results. After an explanation of the problem of identifying causality there is a section looking at how the average farmer has invested in the last year, in order to get an overview of how fast the landscape of the agricultural business is changing. The discussion concludes by looking at possibilities for further research.

7.1 Limitations of the study

There are a few limitations and difficulties with the study. These will be outlined in the following section.

First of all, it is important to understand the limitations that relates to the participants of the survey. It is an established fact that one of the major problems of studying microinsurance is that of finding suitable participants. The potential customers of microinsurance are by definition people that are for some reason outside of societal institutions and are therefore difficult to reach. It is also problematic to find a suitable control group that differs from participants only in one way, namely having an insurance. Farmers who are covered by insurance often differ from other farmers in many ways that might affect levels of investments. For example the farmer might have a higher education, have a better connection to the rest of society and have more access to other forms of financial services. Some of these variables are controlled for, but not all possibilities are taken into account.

In this study, participants mostly consisted of farmers who were somehow tied to the ZNFU office in Choma, and many of them took part in the Lima Credit Scheme. It is important to note that the Lima Credit Scheme does not only consist of an insurance, but also includes a form of lending. There is a great risk that this lending has an impact on the investments we are trying to study. It is also important to note that many of the farmers who were covered by the insurance through the Lima Credit Scheme were not aware of it. In fact, 71.4 percent of respondents said that they took part in the Lima Credit Scheme during the 2014/2015 season, while only 8.2 percent answered that they had some sort of weather insurance. If farmers are not aware that they are covered by insurance their investments cannot increase through any psychological effect. Although, investments may increase as a result of a payout in the case of bad weather conditions.

Not all farmers who were insured had rainfall insurance. In fact, out of the 30.6 percent of farmers who answered that they had any form of insurance during the 2014/2015 season only about one in four said that they had weather insurance. About half of respondents with insurance answered that they had a car insurance. The fact that the farmer was insured at all was still chosen as a variable, since very few farmers answered that they had weather insurance and the data would be meaningless with so few answers. This should be taken into account when looking at the correlations.

7.2 Analysis of the results

The goal of this study was to investigate the effect that microinsurance has on the investment habits of farmers. 10 different measures of increased investing and risk-taking were investigated in this study and 6 of them had some significant relationships involved. It is important to be careful when performing regression analysis to speculate about causality since it can easily lead to faulty and misleading results. This is especially true when working with small effects and small sample sizes, as is the case in this study. With this in mind, the findings of the study are outlined below:

Change of land size
The measure "change of land size" refers to how many hectares of land the farmer has bought or sold during the last year. Investment in land is a straightforward measure of how much money the farmer has put into investments that can increase future incomes. Increases in farm sizes can also be beneficial to the whole community, as larger farms may increase efficiency through economies of scale. The average farmer had increased the size of their farm by 1.4 hectares.

An increase in land size was linked to the farmer having an insurance during the 2013/2014 season. This relationship is significant at the 90 % level, which increased to a 95 % level when controlling for education level. "Having any insurance" means that the farmer answered that he or she had at least one type of insurance. This means that not only weather insurances were included but any other types, such as health, life, funeral, livestock, home or vehicle insurance. Out of the surveyed farmers, 22.4 percent answered that they were covered by some kind of insurance during the 2013/2014 season. Among the covered farmers, 64 percent answered that they had vehicle insurance, 18 percent said that they had weather insurance and 9 percent indicated that they had life insurance. The remaining 9 percent did not indicate what form of insurance they had.

This result indicates that some of the investments in land may be explained by insurances. This supports the hypothesis that insurance has a positive impact on investment levels.

Percentage change of land size
"Percentage change of the size of owned land" refers to how much more land the farmer had during the 2014/2015 season compared to the 2013/2014 season. Using this measure allows for confirmations of the results from "change of land size" as it makes sure that larger farms do not skew the numbers. The average farm was 24.1 hectares big during the 2014/2015 season and had increased by 6.2 percent since the previous season. 14.3 percent of farms had increased in size during the year and none had decreased. The variable "percentage change of size of owned land" can be considered a good measure of the amount of investments made, because it is a measure that is easy to understand partly in terms of how it can be easily observed and measured, and also in terms of how simple it is for farmers to understand and estimate. 78 percent of the surveyed farmers gave a value for the size of their land.

The results confirm the previous conclusions that having insurance is positively correlated with investments in land. The correlation also stands and even increases in significance as it is tested against the other variables. Moreover, both education level and marriage status are found to be negatively correlated with percentage change of land size. This indicates that farmers who have not completed secondary education are more likely to invest in land and the same can be said of unmarried farmers. The reasons for this is unclear, but it points to the importance of including these variables in further research.

Change of number of crops
"Change of number of crops" is a measure of the number of different crop types each farmer grows on their farm and how that number has changed since the previous year. The most popular types of crops were maize, sunflowers, cowpeas, tobacco and ground nuts. The average number of different crops among the surveyed farmers were 3.06 during the 2013/2014 season, which increased to 3.37 until the 2014/2015 season.

Increases in number of crops can be partly explained by the farmer having insurance. This relationship is significant at the 90 % level and still stands after controlling for other variables. It is not immediately clear that the variable "change of number of crops" is a good measure of how much the farmer has invested. One could argue that the number of different crops has more to do with hedging against

different weather-related risks than making investments, which could definitely explain why it would correlate with being insured. However, increasing the number of different crops grown on the farm can often be a big investment for a farmer. They have to learn new ways of sowing and harvesting. They may have to find new distributors and buyers. They may even have to invest in new equipment and tools in order to work with their new crops. In general, a higher number of crops is associated with a higher cost for the farmer.

Willing to take risks

The "willing to take risks" measure indicates how the farmers answered the question "Compared to others, are you willing to take risks on your farm?" A value of 1 means that they responded "yes" and 0 means "no". The measure shows the farmers' self-reported risk taking. Arguably, insurance rates should be lower among more risk-seeking farmers, as insurance is a way to reduce risks.

No significant relationships between willingness to take risks and insurance rates was found. However, marriage status was found to be negatively correlated with a 95 % level of significance. In other words, unmarried farmers were less likely than their married counterparts to report high risk-taking. This could be explained by the idea that farmers with families to feed should be less prone to gamble with their families' incomes. They have more to loose from a year with low incomes.

Change of number of tools

The change of number of tools is a simple measure that denotes the number of tools that the farmer owns, out of a selection of 21 different ones. The tools range from axe and rake to mobile phone and car. The idea is that all tools should be associated with an initial cost that will pay off in the future by facilitating work on the farm. On average, the farmers had 8.98 tools on their farm during the 2013/2014 season, which increased to 9.41 in the following season.

The change of number of tools was not found to be correlated with either measure of insurance. Although, one positive and significant relationship was found with education level. In other words, farmers that have finished secondary or higher education were more likely to have invested in new tools during the last year. One reason behind this is that more highly educated farmers are more likely to be familiar with tools that are technically difficult to handle, such as a water pump or car. Another reason might be that farmers with higher education are more likely to understand the positive effects of investing in new tools and are therefore more prone to do so. The relationship is only significant at the 90 % level and disappears when controlling for gender, marriage status and age. One should therefore be careful before reading too much into this result.

Change of weighted tool index

The weighted tool index is an alternative measure of the number of different tools owned by the farmer. Contrary to the simple measure of number of different tools, the weighted tool index seeks to give a more exact picture of the amount of investments by assigning weights to the different tools. The reasoning is that a water pump is more expensive and harder to take care of than an axe, and should therefore be counted as a bigger investment. The details of how the index is calculated can be found in chapter 5.3. 41 % of farmers increased their weighted tool index and 47 % decreased it.

Just as with the number of tools, an increase in the weighted tool index is correlated with a higher education level. This result is significant at the 90 % level and still stands after controlling for gender, marriage status and age. This further confirms the results from the change of number of tools.

To summarize, being insured was found to be positively correlated with investments in land and investments in new types of crops. The correlation with investments in land was also present when calculating both in absolute terms and in percentage terms. The other relationships underline the importance of controlling for education level and marriage status in this kind of research.

7.3 Investment levels among the surveyed farmers

This section will focus on what the survey says about the investment levels among the farmers. Although it does not directly relate to microinsurance, it is important to understand how the farmers that are the focus of the research work to improve their lives.

In general, the surveyed farmers seem to be making investments and expanding their businesses. It should be noted that there may be some degree of self-selection leading to that conclusion, as more successful farmers might be more likely to complete the survey. There may also be some reason to believe that some respondents exaggerated their investments when completing the survey. However, it seems likely that the farmers around the Choma area were in general investing and becoming more productive. Zambia's agricultural sector increased in productivity by 9.8 percent per year between 2008 and 2012, where the informal agricultural sector grew more than the formal sector (Zambia Institute for Policy Analysis & Research, 2014).

Among the surveyed farmers there is reason to look positively on the future. By looking at how different measures of wealth have increased and decreased during the last year among the respondents we can get a sense of how the average farmer's size and productivity are changing. The average farmer among the respondents had expanded their business during the last year in the following ways:

- The size of the farm had increased by 6.2 percent.
- The number of different types of crops grown had increased by 10.0 percent.
- The amount spent on hired labour had increased by 19.4 percent.
- The number of different tools owned had increased by 4.8 percent.

There were also two measurements by which the average farmer had decreased the size of their operations:

- The amount spent on chemicals such as fertilizer and pesticides had decreased by 8.9 percent.
- The number of animals held on the farm had decreased by 11.0 percent

It should be noted that seeing the use of chemicals decrease does not necessarily mean that the farmers are worse off. There have been strong movements against the use of fertilizers and other chemicals in Zambia in recent years. There are also programmes to get farmers to avoid over-using chemicals on their soil in order to increase harvests and minimize waste, for example agroforestry programmes (Akinnifesi et al., 2008).

It should also be noted that although the number of animals held on the average farm has decreased by 11.0 percent, in reality only 32.7 percent of farmers had decreased their amount of animals. More than half, 51.0 percent, of farms had seen increasing numbers of animals during the last year. There seems to be an issue of a few outliers skewing this statistic by having drastically reduced their amount of animals. In fact, if the four worst offenders are removed from the analysis the number changes from a decrease of 11.0 percent to an increase of 3.9 percent.

The fact that most of these measures have increased drastically gives a sense of how the business environment among the farmers is changing. They give a hopeful message that aligns with the trends we see in Zambian society on the whole.

7.4 Ideas for further research

The area of microinsurance and its effect on farmers and other people is still largely unexplored. Implementation methods are under constant development and have changed much in recent years. It is therefore important that reliable research is done on the mechanisms and effects of microinsurance, both to avoid malpractice but also to evaluate its potential to alleviate poverty.

Much of previous research on the subject has been burdened by the problem of collecting reliable data. Although an inherent characteristic of microinsurance is that obtaining data is difficult, it would be valuable to have more large-scale studies on the subject. Many companies are afraid of entering the microinsurance industry because of uncertainties such as how farmers react to insurance and how the provision can be handled. Meanwhile, many funding organisations are hesitant to microinsurance since it has not yet been conclusively proven to have a positive impact on farmer welfare or national development. It would therefore be fruitful to investigate further the long term consequences of microinsurance. For example, it's effect on the development of a regular insurance industry, as well as what effect increased production and risk-taking has on the farmers' well-being.

8 Conclusion

This study seeks to investigate the effect that microinsurance has on the insured's investment levels, as well as the mechanisms that underlie this effect. This was done partly by modelling the investment decisions of an insured farmer and partly by performing a survey among Zambian farmers, some of whom took part in the Lima Credit Scheme. The Lima Credit Scheme provides farmers with microfinance in the form of both a loan and an insurance.

Past studies on the subject tell us that, in general, microinsurance has been found to have a small positive impact on investment levels and economic growth. This was further confirmed by the model of a farmer's investment decisions developed in the present study. The conclusions drawn from the model were that farmers who are insured against weather-related risks can be expected to increase the levels of investments in their farms, drawing funds away from present consumption.

The results of the theoretical model were supported by the findings of the survey. The responses point to a significant positive relationship between partaking in insurance and two different measures of investment levels. These measures were investment in land and investment in new types of crops. Some significant results were also found linking investments to education levels and marriage status, which emphasises the importance of including these variables in further research.

The conclusion of the study is that there is cause to believe that microinsurance, and specifically weather index insurance, has a positive impact on investment levels among the insured. This is due to a number of mechanisms whereby the insured is motivated to allocate a greater part of their resources away from consumption and saving in favour of investments.

There is a need of further research on the potential of microinsurance to contribute to growth, especially since the concept of microinsurance is still under development and looks to be an effective and comparatively cheap way of alleviating poverty. It is in particular the low-cost nature of microinsurance that makes it appropriate as a tool for poverty mitigation, formation of an insurance industry and as a means of achieving economic development.

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Appendix 1 – Results of the survey

General information		
Number of respondents		49
Gender	Female	14.3 %
	Male	85.7 %
Age	Average	44.4 years
	Range	21 – 63 years
Marital status	Unmarried	4.1 %
	Married	87.8 %
	Divorced	4.1 %
	Widowed	2.0 %
Education level	Primary (grade 9)	34.7 %
	Secondary (grade 12)	61.2 %
	University	2.0 %
Number of people living together on farm	Average	13.4
	Range	3 - 35
District	Choma	42.9 %
	Kalomo	32.7 %
	Pemba	12.2 %
	Sinazongwe	8.2 %
	Chikanta	2.0 %
Owner of land	State owned land	12.2 %
	Customary land	77.6 %
Size of land	Average	24.1 ha
	Median	15 ha
	Range	2 – 117 ha
Change of the size of land since last year	Average	1.4 ha
	Range	0 – 26 ha
	Increase	14.3 %
	Decrease	0.0 %
	No change	83.7 %

Crops			
		2014/2015 season	**2013/2014 season**
Crops grown on farm	Maize	98.0 %	98.0 %
	Sunflower	73.5 %	63.3 %

	Cowpeas	38.8 %	30.6 %
	Tobacco	24.5 %	28.6 %
	Ground nuts	24.5 %	24.5 %
	Fruits	24.5 %	18.4 %
	Soya beans	18.4 %	10.2 %
	Cotton	12.2 %	16.3 %
	Sweet potatoes	8.2 %	4.1 %
	Tomatoes	4.1 %	2.0 %
	Velvet beans	2.0 %	2.0 %
	Beans	2.0 %	2.0 %
	Vegetables	2.0 %	2.0 %
	Sorghum	2.0 %	2.0 %
	Sugar beans	2.0 %	0.0 %
	Water melon	0.0 %	2.0 %
	Wheat	0.0 %	0.0 %
Average number of crops		3.37 crops	3.06 crops
Change of number of crops since last season	Average		0.3 crops
	Range		-2 – 3 crops
	Increase		32.7 %
	Decrease		12.2 %
	No change		55.1 %

Livestock

		2014/2015 season		**2013/2014 season**	
Animals on farm	Cattle	100.0%		93.9%	
	Goats	83.7%		77.6%	
	Sheep	24.5%		22.4%	
	Pigs	30.6%		30.6%	
	Broiler chickens	8.2%		8.2%	
	Layer chickens	2.0%		2.0%	
	Local chickens	95.9%		87.8%	
	Guinea fowl	26.5%		26.5%	
	Turkeys	4.1%		4.1%	
	Ducks	2.0%		2.0%	
Number of animals on farm		Total average	Average non-zero	Total average	Average non-zero
	Cattle	14.0	14.0	12.7	13.5
	Goats	15.3	18.3	15.8	20.4

	Sheep	2.8	11.5	3.6	15.8
	Pigs	2.5	8.1	3.8	12.5
	Broiler chickens	6.1	74.5	6.0	73.8
	Layer chickens	0.8	40.0	1.2	60.0
	Local chickens	26.3	27.4	31.9	36.3
	Guinea fowl	2.0	7.6	2.1	8.1
	Turkeys	0.2	4.5	0.4	10.0
	Ducks	0.2	12.0	1.2	60.0
Total number of animals on farm	Average	70.2 animals		78.8 animals	
	Range	3 – 241 animals		0 – 265 animals	
Change of total number of animals	Average			-8.7 animals	
	Range			-154 – 42 animals	
	Increase			51.0 %	
	Decrease			32.7 %	
	No change			16.3 %	
Weighted livestock index		**2014/2015 season**		**2013/2014 season**	
	Average	3.776		4.308	
	Range	0.195 – 9.380		0.000 – 16.682	
Change of weighted livestock index	Average			-0.532	
	Range			-9.588 – 2.736	
	Increase			49.0 %	
	Decrease			36.7 %	
	No change			14.3 %	

Insurance

Taking part of the Lima Credit Scheme		**2014/2015 season** 71.4 %	**2013/2014 season** 53.1 %
Taking part of any insurance		30.6 %	22.4 %
Type of insurance	Health	0.0%	0.0%
	Life	2.0%	2.0%
	Funeral	2.0%	0.0%
	Weather	8.2%	4.1%
	Livestock	2.0%	0.0%
	Home	0.0%	0.0%
	Vehicle	14.3%	14.3%

Farm practices			
Use of tractor or draft animal power on land		**2014/2015 season**	**2013/2014 season**
		83.7 %	83.7 %
Use of chemicals (such as fertilizer, pesticide or weed-killer) on land	Have used	81.6 %	81.6 %
	Average cost	3 751 ZMW	4 117 ZMW
	Average non-zero cost	4 967 ZMW	5 452 ZMW
	Range	0 – 21 500 ZMW	0 – 80 000 ZMW
Change of cost of chemicals since last season	Average		-366.4 ZMW
	Range		-58 500 – 127 ZMW
	Increase		44.9 %
	Decrease		18.4 %
	No change		36.7 %
Use of labourers on land		**2014/2015 season**	**2013/2014 season**
	Have used	61.2 %	63.3 %
	Average cost	734 ZMW	615 ZMW
	Average non-zero cost	1 200 ZMW	1 005 ZMW
	Range	0 – 10 550 ZMW	0 – 5 000 ZMW
Change of cost of labourers since last season	Average		119.3 ZMW
	Range		-2 450 – 5 550 ZMW
	Increase		32.7 %
	Decrease		26.5 %
	No change		40.8 %
Compared to others, are you willing to take risks on your farm?	Yes		53.1 %
	No		32.7 %

Tools			
Tools owned		**2014/2015 season**	**2013/2014 season**
	Hoe	83.7%	85.7%
	Axe	79.6%	81.6%
	Rake	61.2%	65.3%
	Shovel	67.3%	69.4%
	Slasher	63.3%	61.2%
	Mattock	40.8%	34.7%
	Sickle	44.9%	42.9%
	Plough	77.6%	75.5%

	Ridger	16.3%	16.3%
	Cultivator	42.9%	32.7%
	Harrow	46.9%	40.8%
	Water pump	20.4%	18.4%
	Wheelbarrow	42.9%	40.8%
	Tractor	2.0%	2.0%
	Sprayer	69.4%	59.2%
	Mobile phone	75.5%	67.3%
	Bicycle	81.6%	81.6%
	Motorbike	6.1%	10.2%
	Car	10.2%	6.1%
	Trailer	4.1%	2.0%
	Other vehicle	4.1%	4.1%
Number of tools owned	Average	9.41 tools	8.98 tools
	Range	0 – 16 tools	0 – 16 tools
Change of number of tools owned since last season	Average		0.43 tools
	Range		-2 – 4 tools
	Increase		34.7 %
	Decrease		12.2 %
	No change		53.1 %
Weighted tool index		2014/2015 season	2013/2014 season
	Average	21.00	21.00
	Range	0 – 106.32	0 – 113.58
Change of weighted tool index since last season	Average		0.00
	Range		-25.1 – 23.41
	Increase		40.8 %
	Decrease		46.9 %
	No change		9.2 %

Appendix 2 – The survey

Dear respondents,

This questionnaire seeks to collect information on the investment habits among farmers in your area. Your input will be used for research about insurance.

In this survey, we will ask about your household, your farm, whether you take part of an insurance programme and your investment habits during the last year.

The questionnaire will take approximately 20 minutes to complete. You do not have to participate if you do not want to. If you decide to participate you can refuse to answer any question or stop at any time.

Please do not indicate your name or any form of identity on this questionnaire. We wish to keep your responses and identity confidential.

Thank you for participating!

The household and the farm

1. What is your age?	_____ years
2. What is your sex/gender?	☐ Female ☐ Male
3. What is your marital status? *Examples: Unmarried, Married, Widowed, Separated*	_____
4. What is the highest class or qualification that you have successfully completed? *Examples: Nursery, Primary, Secondary, University degree, None, Others*	_____
5. How many people are living together with you on your farm?	_____ people
6. Which district do you live in?	_____

7. Do you have land of your own?	☐ Yes ☐ No	
8. Who owns the land on which you are currently farming?	☐ Government state land ☐ Customary/Traditional land	
9. What is the size of the land you are working on?	_____	Unit: ☐ Square meters ☐ Hectares ☐ Acres ☐ Lima
10. Have you acquired any land the last 12 months?	☐ Yes ☐ No	
If yes, how much land have you acquired?	_____	Unit: ☐ Square meters ☐ Hectares ☐ Acres ☐ Lima
11. Have you sold any land the last 12 months?	☐ Yes ☐ No	
If yes, how much land have you sold?	_____	Unit: ☐ Square meters ☐ Hectares ☐ Acres ☐ Lima
12. What types of crops are you cultivating during this farming season (2014/2015)?	☐ Cotton ☐ Maize ☐ Sunflower ☐ Cowpeas ☐ Tobacco ☐ Soya beans ☐ Wheat ☐ Fruits ☐ Other crops, please specify: _____ _____	

13. What types of crops did you cultivate during **the previous farming season (2013/2014)**?	☐ Cotton ☐ Maize ☐ Sunflower ☐ Cowpeas ☐ Tobacco ☐ Soya beans ☐ Wheat ☐ Fruits ☐ Other crops, please specify: _____ _____

14. What types of livestock do you have on your farm? Please indicate the number of animals you have of each kind.	**Animal:**	**Number of animals:**
	Cattle	
	Goats	
	Sheep	
	Pigs	
	Broiler chickens	
	Layer chickens	
	Local/Village chickens	
	Guinea fowl	
	Other animals, please specify: _____ _____	

15. What types of livestock did you have on your farm during **the previous farming season (2013/2014)?** Please indicate the number of animals you had of each kind.	**Animal:**	**Number of animals:**
	Cattle	
	Goats	
	Sheep	
	Pigs	
	Broiler chickens	
	Layer chickens	
	Local/Village chickens	
	Guinea fowl	
	Other animals, please specify: _____ _____	

Insurance

In the following questions "this farming season" refers to the current season (2014/2015). "The previous farming season" refers to the last one (2013/2014).

This farming season (2014/2015)

16. Are you taking part in the Lima Credit Scheme provided by Zambia National Farmers' Union?	☐ Yes ☐ No
17. Do you or anybody in your family have any insurance cover?	☐ Yes ☐ No
If yes, please indicate which types of insurance you have.	☐ Health insurance ☐ Life insurance ☐ Funeral insurance ☐ Rain/weather insurance ☐ Livestock/cattle insurance ☐ Home insurance ☐ Vehicle insurance ☐ Other types, please specify: _____ _____
Through which company or organisation have you got your insurance?	_____ _____

The previous farming season (2013/2014)

18. Did you take part in the Lima Credit Scheme provided by Zambia National Farmers' Union?	☐ Yes ☐ No
19. Did you or anybody in your family have any insurance cover?	☐ Yes ☐ No
If yes, please indicate which types of insurance you had.	☐ Health insurance ☐ Life insurance ☐ Funeral insurance ☐ Rain/weather insurance ☐ Livestock/cattle insurance ☐ Home insurance ☐ Vehicle insurance ☐ Other types, please specify: _____ _____
Through which company or organisation did you get your insurance?	_____ _____

Risk taking and investments

20. During **this farming season**, have you used a tractor or draft animal power on your land at any time?	☐ Yes ☐ No
21. During **the previous farming season**, did you use a tractor or draft animal power on your land at any time?	☐ Yes ☐ No
22. During **this farming season**, have you used any chemicals such as fertilizer, pesticide or weed-killer (herbicide) on your farmland?	☐ Yes ☐ No
If yes, what is the estimated total cost of the chemicals?	_____ Kwacha ☐ The chemicals were provided through a programme.
23. During **the previous farming season**, did you use any chemicals such as fertilizer, pesticide or weed-killer (herbicide) on your farmland?	☐ Yes ☐ No
If yes, what was the estimated total cost of the chemicals?	_____ Kwacha ☐ The chemicals were provided through a programme.
24. During **this farming season**, have you hired any labourers (workers) to perform work on your farm?	☐ Yes ☐ No
If yes, how much would you estimate you have paid in total for the labour?	_____ Kwacha
25. During **the previous farming season**, did you hire any labourers (workers) to perform work on your farm?	☐ Yes ☐ No
If yes, how much would you estimate you paid in total for the labour?	_____ Kwacha
26. Compared to others, are you willing to take risks on your farm?	☐ Yes ☐ No

27. Do you or anybody in your household currently own any of the following? Please indicate which ones you own.	☐ Hoe ☐ Axe ☐ Rake ☐ Shovel ☐ Slasher ☐ Mattock or pickaxe ☐ Sickle or reaping hook ☐ Plough ☐ Ridger ☐ Cultivator or tiller ☐ Harrow ☐ Water pump ☐ Wheelbarrow ☐ Tractor ☐ Sprayer or spraying machine ☐ Mobile phone ☐ Bicycle ☐ Motorbike ☐ Car ☐ Trailer ☐ Other vehicle (such as lorry or boat)

28. **One year ago**, did you or anybody in your household own any of the following? Please indicate which ones you owned.	☐ Hoe ☐ Axe ☐ Rake ☐ Shovel ☐ Slasher ☐ Mattock or pickaxe ☐ Sickle or reaping hook ☐ Plough ☐ Ridger ☐ Cultivator or tiller ☐ Harrow ☐ Water pump ☐ Wheelbarrow ☐ Tractor ☐ Sprayer or spraying machine ☐ Mobile phone ☐ Bicycle ☐ Motorbike ☐ Car ☐ Trailer ☐ Other vehicle (such as lorry or boat)

Do you have anything else to add or any comments about the survey?

Thank you for participating!