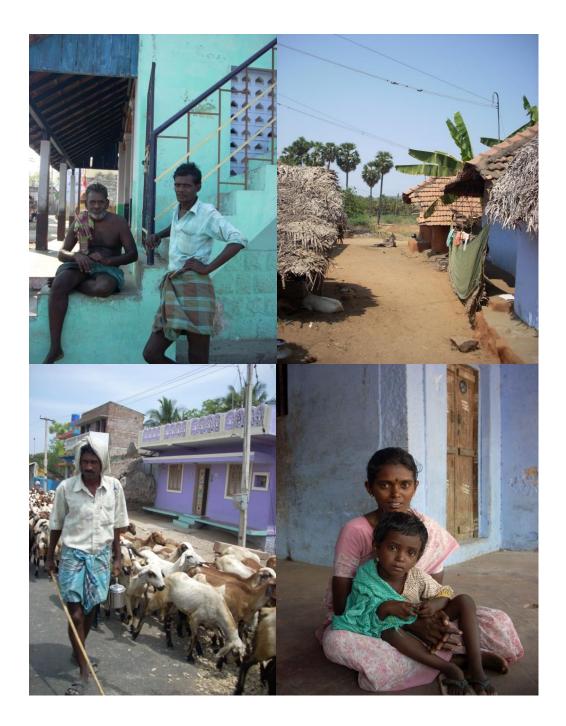# KEEPING UP THE AGRICULTURAL TRADITION
COPING STRATEGIES OF FARMERS IN TAMIL NADU

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KEEPING UP THE AGRICULTURAL TRADITION
COPING STRATEGIES OF FARMERS IN TAMIL NADU
"We stay in agriculture because it's our tradition. If we leave, nobody can eat!"
(Theeyanur, 12-03-2010)

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1 Introduction

Farmers in rural areas often rely on agriculture and hence weather for their income. When extreme weather conditions occur, their livelihoods can become under severe pressure. Currently, natural disasters such as droughts, floods, pests and cyclones happen more frequently and are more unpredictable. Therefore, a lot of farmers in developing countries face difficulties to secure their income (Skees 2007). Farmers do not always have enough possessions and strategies available to cope with the consequences of these weather changes. For instance, they might not have enough savings to compensate for a reduced crop yield. Whether farmers live at a subsistence level or have additional income sources, they all rely to some extent on their own crop production. As a result, the changeability of the weather influences their overall welfare (Skoufias 2003). Moreover, the applied coping strategies can have negative consequences because for instance productive assets might be lost (Skees & Collier 2008) which upholds the vulnerability of a household (Skoufias 2003). Thus, recurring disasters such as droughts could limit the feasibility of agriculture as main form of livelihood or as a main source of income for farmers (Moench & Dixit 2004).

1.1 Problem definition

Since farmers face many weather related problems, it is important to look at which options farmers use to cope with these natural disasters. It is especially valuable to know which factors influence their decisions to use certain strategies. Examples of influencing factors could be for instance financial capital (such as income), social capital (such as household size or the caste) or human capital (age, education). It is possible that older farmers have fewer coping options because their health has deteriorated and they are less able to work on the farm or in another job. Therefore, these older farmers might have no savings and are not able to gain additional income. Family and friends perhaps do not want to borrow money to them, because they never will able to pay back the money. Income might also be a factor which influences the choice of coping strategies. Poor farmers might have fewer coping possibilities than rich farmers. On the other hand, rich farmers could be in less need to use coping strategies.

In general, many studies focus a lot on the influence of income on the various coping strategies and less attention is paid to other factors influencing coping decisions. Therefore, the question arises which other factors are important reasons for farmers to deal with disasters in a specific way. Are there other significant influences? Are their reasons for farmers to apply particular strategies? Perhaps, their coping options are limited by specific factors such as age or land size. For instance, farmers with a bigger land size can more easily take a formal loan because they can give their land as collateral. Perhaps, bigger households cope in another way than smaller households. Members in small households might have to work on their own land after a disaster and do not have time to migrate to another city. Bigger households can more easily send a member to another city or district.

An increased knowledge on what factors make farmers prefer one strategy over the other or limit farmers to use certain strategies, could give better insights into their agricultural existence. How do farmers come to their decisions? In other words, why do they apply specific coping strategies? Or in what way are their choices limited? So far, not many answers to these questions can be found in the literature. Since a large part of the literature, which I read, has focused mainly on income as an influencing factor, I have tried to reason which other factors might influence coping decisions. These factors are largely based on Tamil Nadu and are tested during the field research in Tamil Nadu.

Finally, by knowing what factors influence coping decisions, policy makers, NGOs and micro insurance providers can learn a lot and become aware of the various coping strategies used by farmers. Hence, they can adapt their products and their approach to the context of the farmers' livelihoods.

1.2 Research Questions

"Households experience quite different pressures and opportunities that are adopted as livelihood and coping strategies. However many factors, which are to be studied in-depth, influence the choices of these opportunities made across the households."(Mishra 2007, p.186)

I have tried to investigate the following question: *which factors influence Tamil Nadu's farmers' decisions for coping strategies and how do these factors influence their decisions?*
Does this for example depend on their income, age, land size or the district where they live? In this thesis I will be analyzing what coping strategies farmers use, when they face disasters. Why do various farmers deal differently with the shocks that are so inherently attached to their agricultural existence?

Although ex-ante and ex-post coping strategies were both very interesting to investigate, this research has focused on ex post strategies. The reasons for this choice are two-folded. Firstly, this topic was more feasible to research during field work within the given time frame. Secondly, it was valuable to know how and why farmers react in a different way to disasters. The question refers to various factors that influence coping strategies. These factors relate to human, social, financial, natural and physical capital. The definition of farmers in this research is as follows: 'People who cultivate land'. They can both own land and cultivate it or rent land in and cultivate it. Wage labor is not part of this definition of a farmer. People who own land, but do not cultivate the land, are also no part of this definition. To get an answer to the main question, the following sub questions were answered:

1. Which natural disasters do farmers in Tamil Nadu face? How often do these disasters occur and to what extent are they covariant?

2. What are the concrete (ex post) coping strategies that farmers use, when they face the natural disasters? What are the advantages and limitations of these strategies?

3. How and why do different factors influence farmers in Tamil Nadu to decide to use different coping strategies to deal with natural disasters?

1.3 Significance

The frequency and the unpredictability of natural disasters increase. Therefore, more attention is directed towards coping with these disasters. It is important to keep paying attention to the coping strategies (UNFCCC 2003; Bhattacharya and Das 2007). It is necessary to figure out how various factors influence the use of different coping strategies in Tamil Nadu to manage these natural disasters. Moreover, although much attention is paid to the various types of coping strategies that farmers use after natural disasters, what is often lacking is the explanation why those strategies are used. What is the reason that farmers do not deal in the same way with the disasters? What makes one farmer choose other strategies than the other farmer? Farmers, who have more assets available, can probably get more easily a formal loan because they have collateral. Farmers who have fewer assets might not be able to get this formal loan and rely on a moneylender for money. Farmers, who do not possess livestock, are not able to sell livestock in order to cope. Higher educated farmers might have better jobs and more income. As a result, they might not need to use stressful coping mechanisms, such as taking children out of school or selling their productive assets. These above stated suggestions, are merely assumptions. It is not very well known, whether these

statements are true. Therefore, I am going to research whether particular factors influence the coping decisions of farmers in Tamil Nadu. When these factors are known, it is possible to form recommendations for policymakers and the suppliers of microinsurance (this can be NGOs like DHAN Foundation, insurance companies and policymakers) in Tamil Nadu. In this way, they can adjust their policies and, for instance, their insurance products to provide the best product possible.

1.4 Outline

The outline of this thesis is as follows: chapter two provides the background on India. Thereafter, a conceptual and a theoretical framework are given in chapter three. This is necessary to understand the issues related to the research. What is capital, what is risk and what exactly do coping strategies imply? Moreover, what are influential factors on coping strategies? Next, chapter four describes the used methodology of the research and the data. Chapter five elaborates on the analyses and the results. The conclusion and discussion are given in chapter six. In addition, chapter seven provides the recommendations for providers of microfinance. The references and annexes with questionnaires and data results are given in the last two chapters, eight and nine.

2 Background

I have carried out the research in the rural areas of Tamil Nadu in India. Therefore, it is important to understand the specific culture and context of India. In this section, first a background on India, Tamil Nadu and the rural areas is given. Thereafter, more is explained about the culture in India and the NGO 'DHAN Foundation'.

Figure 1 Map of India

Source: www.matrifocus.com/IMB09/madurai-map.htm

2.1 The country

India is a country that covers around 3.28 million km². With more than 1.1 billion inhabitants, it constitutes of more than sixteen percent of the global population. Around seventy percent of the Indian population relies on activities that depend on climate, such as agriculture (Bhattacharya & Das 2007). Approximately three hundred million people live below the poverty line, which is about 35 percent of the population. Farmers in India often live in remote rural areas and their livelihoods rely for a big part on agriculture. Around sixty percent of the sown area depends on rain and forty percent depends on irrigation (Qureshi & Reinhard 2008, p.24). As a result, farmers face many risks related to weather. Rain fed farmers countenance a variety of risks in their livelihoods. A very important risk is the risk of low production, which can be caused by disasters such as pests and diseases, droughts, floods and tsunamis. In rain fed agriculture about sixty to eighty percent of the yield results from sufficient and properly distributed rainfall (Karthikeyan 2009). Since India is such a big agricultural economy, it is an interesting country for this research. The weather conditions are becoming increasingly extreme and unpredictable, so the farmers in Tamil Nadu face more and more difficulties. It is suggested that the incidence of heavy rainfalls over major parts in India will increase. Furthermore, the average temperature in India is estimated to increase within a range of 2.3° C to 4.8° C. The CO_2 concentrations are estimated to double (Bhattacharya & Das 2007). Floods and droughts are already major recurring disasters in India. Each year, forty million hectares of land in

India is flooded. Some parts of India, such as western Rajasthan and the Kutch region in Gujarat are drought-affected areas (Moench & Dixit 2004). Tamil Nadu, the area of research is also a drought-prone region. An increased intensity and incidence of natural disasters like droughts and floods are anticipated (Bhattacharya & Das 2007, p.2).

2.2 The Indian culture and context
India is an interesting country to research because of the large agricultural economy and also because of the fact that the culture has a big influence on the daily lives of the farmers. The variety in people, castes and status has an impact on the coping strategies of farmers. Cultural and social influences on coping mechanisms within the Indian society are mainly related to gender and caste. Caste plays an important role in the Indian society and influences the coping strategies as well. Farmers of a higher caste cannot work for farmers of a lower caste. After a disaster they do not want to work as a wage laborer or take a job in the city, because that is not possible as a high caste 'Brahman'. Lower castes, on the other hand are limited by their status because they cannot get some types of jobs. Several types of non-farm jobs are only possible for higher casts. For the lowest castes, it is even difficult to borrow money. Other castes and moneylenders from higher castes do not want to borrow money to them. The status is very important to the Indian people as well. As a result, people might prefer to sell their land as a coping mechanism instead of going to work in another region. In this way, their concern for their social status makes them sell productive assets instead of trying to diversify their income (Mishra 2007). Gender is an important factor as well. For example, when education becomes too expensive, first girls are taken out of school. In some regions women do not work outside of the home. Consequently, the coping mechanisms of women after a disaster are also different. It might not be feasible for them to find a job outside of agriculture to raise income after a shock. However, in other regions (such as Tamil Nadu) the women will increase their labor after a disaster. Some women work for example as wage laborer (Moenx & Dixit 2004). Hence, it is important to recognize the influence of cultural factors on the types of coping mechanisms. A culture can stimulate coping measures or reduce the opportunities of coping. These cultural factors that influence coping strategies are difficult to analyze since it is part of the culture and not very tangible.

2.3 DHAN Foundation
I have done the research for DHAN (Development of Humane Action) Foundation, because I came into contact with them through my internship. The DHAN Foundation is a non-governmental organization (NGO) that was initiated on 2 October 1997. The mission of this NGO is stated as follows: "*Building people and institutions for development innovations and up scaling to enable the poor communities for poverty reduction and self-reliance*" (DHAN Foundation 2009). DHAN also pays attention to the impact of climate change on farmers and focuses on agricultural insurance and disaster management. The NGO carries out pilot projects together with the facilitation of the Advanced Centre for Disaster Risk Reduction. This centre is housed in the Tata–DHAN Academy. It tries to reinforce disaster preparedness and management strategies within the Peoples' Organizations to manage the negative effects of climate change. Moreover, the 'Advanced Centre for Skill and Knowledge on Mutual Insurance (ASKMI) has undertaken several pilots and research projects together with DHAN. Jointly, they work on improving knowledge and practice on disaster risk reduction. In addition, there are two projects on deficit rainfall insurance with small rain fed farmers and on agriculture insurance (DHAN Foundation 2009). DHAN Foundation also works in the area of coping strategies for natural disasters, which was useful for my research. The NGO assists the poor in diversifying their range of assets and also helps them to share their risks. So far, key challenges for the organization are covering high-risk members and spreading the risk of natural disasters. This is a difficult task, because disasters have covariant risk which can affect all the members of a risk pool (ProVention 2004). DHAN foundation also acknowledges other ways of disaster risk reduction. It recognizes the importance of local knowledge and coping strategies. They are interested in the possible use coping strategies as an alternative or complement to crop insurance, or in combination with crop insurance to get an optimal result for the poor population.

3 Theory

To comprehend the importance of the risks of farmers and their coping strategies, the understanding of a few concepts is necessary. It is essential to grasp several concepts that were used in the research. I will clarify the concepts of types of capital, which are important for the farmers' livelihoods, risks, which farmers face and finally coping strategies, which farmers use to deal with natural disasters. After these concepts are clear, I will be able to discuss the theory on coping strategies in further detail.

3.1. Conceptual framework

3.1.1 Capital

Assets are essential to ensure the livelihoods of farmers, but farmers face difficulties to gain access to various types of assets. Consequently, they have problems to fulfill their livelihood needs. They need to find ways to combine the few assets they possess to be able to cope. The next section explains the different types of assets or capital and the importance of these, for the rural poor (DFID 1999).

Assets can be classified into human, physical, social, financial and natural capital. The concept of human capital is related to the available knowledge, working capacity, skills and health of people. An example of *human capital* at the household level is the measurement of the quality of labor. This quality can differ according to the size of the household, the level of the skills, the health condition of the household members, etcetera (DFID 1999). *Physical capital* entails the basic infrastructure and producer goods, where livelihoods rely on. Examples are well constructed roads and buildings, public transport, as well as access to clean water and energy. For instance, when farmers have no access to clean water, they become ill more easily. If there are no good roads and public transport, farmers have no access to hospitals or markets to buy for instance food or fertilizers. The term *social capital* involves the social resources, where farmers depend on to ensure their livelihoods. These resources can be social networks, membership of formal groups with formal rules and obligations, informal safety nets, and relationships based on trust and reciprocity. When a household has financial problems, it can rely on the family, friends or neighbors for help.
Financial capital implies the financial resources that farmers have. Important financial assets are income, remittances, pensions or credit. A household can also have savings in the form of cash, livestock or jewelry. This financial capital can be used to realize livelihood outcomes.
Natural capital is the stock of natural resources that farmers need to ensure their livelihoods. These resources can provide services, such as nutrient cycling or erosion protection. Natural capital can entail public goods that are intangible such as the biodiversity. However, it can also involve tangible privately owned assets, such as trees and land. Natural capital is often very important for farmers, because their livelihood depends on resource based activities in the agriculture (DFID 1999).

3.1.2 Risk

Risk refers to the variability of the outcome of an uncertain situation and risk also involves a loss. Thus, risk is uncertainty plus loss (Kaplan & Garrick 1981). Risks are unpredictable events that have a negative outcome (Hung 2007). Another important aspect is the variation in the severity of a risk, which implies the relative size of the loss. The uncertainty of a risk depends on whether a risk will occur, when it will occur and how often it occurs. For instance, it is less certain when and how often a

drought will occur than whether a very old person dies. Moreover, the size of the loss has influence on the ability to cope with the risk. A household is probably better able to cope with a temporarily illness of a household member than a severe drought (Brown & Churchill 1999). In general, there are three sources of risk. The first source entails unexpected emergencies or crises, such as the death of a family member or fire. The second risk involves events that have high costs, like funerals or marriage. The last source deals with structural aspects such as the variation in weather and seasonality (Hung 2007). This research has focused on the third source of risk, namely natural disasters.

Risk implications for people with low incomes
Farmers, with low incomes, are often more vulnerable to risks (Churchill et al. 2006). They often live in environments that create more risk towards personal wellbeing, such as bad sanitation and poor hygiene. A drought might not affect the lives of rich farmers, while it has a disastrous effect on the livelihoods of poor farmers. In general, wealthier farmers can rely on savings to help them recover. Poor farmers do not necessarily have those kinds of savings to fall back on (Pandya & Mitchell 2006). Since they possess fewer assets, particular hazards can have severe consequences for farmers with low incomes. Hence, they have more difficulties spreading their risks and they have problems coping with risks and securing their livelihoods.

Idiosyncratic risk and Covariant risk
An idiosyncratic risk involves an event which affects only one household or a small number of households at the same moment (Hung 2007). In this case the risk is spread and the risks of the farmers are not correlated. Therefore, the probability that the insured event happens to many farmers at the same time is very low. Covariant risks on the other hand, are events that result in large losses for a great part of a population at the same time (Brown & Churchill 1999). Examples are natural disasters and widespread diseases. Covariance implies that risks amongst the farmers in the risk pool are related to each other. Thus, when one farmer faces the risk, there is a big chance that the other farmer faces that same risk as well. Farmers living in a disaster-prone area encounter for instance the same risks such as floods and droughts (Churchill 2003).

3.1.3 Coping strategies
"Those with the least ability to adapt are being affected most by climate change, (…….): there has never been a greater need to protect these communities" (Lloyd's 2009, p. 35)

In many developing countries farmers live in areas, where natural disasters occur. For centuries these people have had to deal with these shocks, such as floods and droughts, and they have created their own strategies and methods in order to protect their livelihoods. Coping strategies imply that this knowledge and these skills are used to cope with natural hazards. The strategies can vary with the type of disaster, the area where the disaster takes place and the farmers that have to deal with it (Twigg 2004).

Ex-ante management strategies
An ex-ante or a precautionary strategy is an approach, used by households, to protect themselves from future risks. The household increases its assets, recourses and opportunities in the event of a shock or disaster. In that way, the vulnerability of the household reduces (Hung 2007, p.9). Thus, the main goal of an ex ante strategy is income smoothening. There are three types of strategies to smooth income: risk avoidance, risk transfer and risk reduction. An example of avoiding risk is moving out of a disaster-prone area. Transferring risk to a third party can be done through insurance (Lekprichakul 2007). Examples of risk reduction are the diversification of income and economic activities, and saving money or food (Hung 2007). Microinsurance is also a risk management strategy and it entails that the poor pay regular small amounts of premium as a compensation for the

uncertainty of a high exceptional loss (Brown & Churchill 1999, p. 2; Lloyd's 2009, p.6). Therefore, it can be an instrument to help farmers to manage their agricultural risks.

Ex-post coping strategies
Ex-post strategies are different from ex-ante strategies since the households manage their loss after a risky event has occurred. Whether households are able to manage their loss depends on several aspects. Their available resources, the size of the loss, the type of event and the duration of the event influence the ability to cope (Hung 2007). Farmers often attempt to raise extra income. In that way, they can compensate for the deficit income due to the shock (Lekprichakul 2007). Examples are selling assets to gain income, migrating to the city to employ in non-farm labor and using loans or insurance (Hung 2007). Another ex-post method is reducing the consumption in order to preserve productive assets (Lekprichakul 2007). Claiming from agricultural insurance and using savings are in this research also regarded as a ex-post coping strategy. Taking agricultural insurance is an ex-ante strategy, but whether the claim is made or not, is chosen after the disaster has occurred. Saving money or food is done before a disaster happens, but whether the savings will be used to deal with the disaster, is a choice made afterwards as well.

3.2. Theoretical framework
3.2.1 The coping strategies
"Households in risky environments have developed sophisticated (ex-ante) risk-management and (ex post) risk-coping strategies, including self-insurance via savings and informal insurance mechanisms" (Dercon 2000, p.3).

Economic strategies:
When farmers experience a shock, they can use various economic strategies to deal with the consequences. Firstly, some farmers try to handle their reduction in income or food production by changing their consumption pattern by means of reducing their consumption or reducing their expenditures (Selvaraju, Subbiah, Baas & Juergens 2006). Income can hereby influence the choice for strategies. Poorer farmers have for instance more difficulties to use other coping mechanisms. Reducing their consumption is in that case one of the few strategies possible and this can lead to reduced health conditions. Richer farmers reduce more often their expenditures on social functions and rituals instead of food during disasters (Moench & Dixit 2004). The consequences are less severe, because it has no effect on their health. Another way is reducing the costs of agriculture. This is not always possible because disasters can increase the need to invest in agriculture. It differs per household, whether it is possible to reduce these costs. Farmers, who employ wage laborers can hire fewer laborers and work more themselves. On the other hand, poor farmers who do not have the money to employ wage laborers cannot reduce these costs on wage laborers and are, therefore, less able to reduce their agricultural costs. Another example of coping is the spending of savings as a means to have sufficient food intake to survive. In that case, the depletion of the savings compensates for the faced losses due to the shock. However, when poorer or older farmers do not have enough savings, they have to take other measures. It is possible that children are taken out of school to send to work or productive assets are sold to gain additional income. These strategies are stressful, because they can have negative effects in the long run. Selling productive assets is a short term solution, because in the long run it reduces the revenues of the household. Taken children out of school is a short-term solution as well, because the children do not get well educated and the human capital is reduced. The children cannot easily find a higher skilled job and, therefore, they depend more on agriculture. This makes it more difficult for them to spread the risks, related to the income. The selling of livestock, jewelry, land, vehicles, houses, or other productive belongings is an often used approach to get money to smooth consumption. It has to be stated that poorer households have fewer assets to sell, which increases their vulnerability and gives them fewer coping options. As a result, these households could be more affected by disasters.

Coping with risk is often done by trying to earn extra income as well (Dercon 2000). Farmers can rent out land during or after a natural disaster. The advantage of this approach is that farmers experience less income risk and they have a stable income from the rent. The disadvantage is that the returns are lower, because less risk is taken. In a good year, the farmers could have earned a lot of income, but they will only get the rent of the land instead of the revenues from the yield. Sometimes, a family member migrates for a longer period to a city far away or another country in order to send back remittances. These remittances can be an important source of income for farmers during crises. Less educated farmers cannot migrate easily for a long term period, because these jobs require a higher education level. Furthermore, the daily expenses in those cities or other countries are mostly higher, which makes it more difficult for poor farmers to migrate for a long period. Money is also needed for the 'start-up costs' in order to be able to send a member to migrate. This makes it a less accessible strategy for farmers who do not possess sufficient money or have a low level of human capital. It is difficult for farmers to get a loan at the bank in order to send a member to another city. In some cases, farmers borrow from informal moneylenders, because this is the only way to obtain enough money in order to help a member migrate. In general, diversification of the income is a less stressful coping strategy in order to reduce the vulnerability of households and increase their capacity to adapt to difficult circumstances. This diversification is not only done by long term migration but also by daily migration and wage labor in agriculture. Daily migration and wage labor are more easily accessible strategies, because the educational requirements are less and there are no 'start-up costs'. Traveling every day to the city to work in the construction is an example of daily migration, whereby labor is more important than education. For wage labor in agriculture, farmers already have the skills to work on the land. These coping strategies can contribute to income diversification and a reduction in the vulnerability of the household (Seraydarian et. al 2009). (However, when a covariant risk occurs, less labor might be needed on the land and hence less job opportunities for wage laborers are provided.)

Giving collateral in order to get a loan is also a coping strategy in this research. For farmers in Tamil Nadu who use this strategy (and hence for this research), collateral implies jewelry. They give a part of their golden jewelry to get some immediate money in order to cover the costs. For formal lending from a formal bank, other collateral is needed (such as land). When farmers borrow money, they often use a cash loan from friends, family or a moneylender. Loans from friends or family are mostly small amounts of money, because they do not always have a lot of money themselves. In case they need more money, farmers often have to go to informal moneylenders, because they do not have access to formal credit. This makes these informal ways of borrowing essential to create income for important income raising activities (Moench & Dixit 2004). The disadvantage of borrowing from an informal moneylender is the high interest rate which can put farmers into even higher debts. This strategy can provide a household with necessary money in the short-run, but it often increases the vulnerability of a household in the long-run. Borrowing from a formal bank or microfinance institution is a coping strategy which does not happen often, because farmers do not have easily access to this type of formal coping mechanisms. The reason is that credit markets often are absent or not working well (Dercon 200). Farmers also lack the hard collateral (such as land) that is needed to get a formal loan. Agricultural insurance is another way to deal with natural disasters. Microinsurance offers poor people post-disaster money which helps them to protect their livelihoods and start to rebuild their life (Mechler, Linnerooth-Bayer & Peppiatt 2006, p.7). It can be argued that from a microeconomic viewpoint, insurance leads to more efficient economic outcomes. However, agricultural insurance is not yet provided on a large scale and the viability and sustainability of this type of insurance is not assured so far. Currently, NGOs are the main providers of agricultural insurance in Tamil Nadu. Farmers, who are no member of an NGO, probably have no access to agricultural insurance yet. To conclude, the poorer farmers with fewer assets (or financial capital) have fewer options to smooth consumption. Older farmers and the less educated farmers, who have less human capital, are assumed to have fewer options to smooth consumption as well. They face more difficulties to diversify their income by various means, such as migration, non-farm labor and

attracting formal credit and are more often limited to reducing consumption or working as a wage laborer in agriculture in order to cope.

Social strategies
Social capital plays a big role in social coping strategies. First, households can look for help within their family and the size of the household can influence 'social strategies', because there are more people in the surroundings to help each other out. A cousin, who is part of the household, can help out the head of the household by working extra in order to gain money. Hence, bigger households have more members to help out after a natural disaster. There are for instance more members available to work extra on the land in order to replace wage laborers and reduce the agricultural costs. Some members can find an extra non-farm job or migrate for a period. More members in the household can result in more coping options. However, it has to be stated that more members also require more food. These bigger households could, therefore, be more often in need to apply extra coping strategies.

The relationships with other members of the community are very important as well to help farmers deal with disasters. When farmers can rely on other neighbors, friends, family or community members to support them during difficult times, this reduces their vulnerability. They can for instance borrow some money, food or get help by finding a job. Therefore, coping with help of others is a more effective mechanism than coping on their own (Brown and Churchill 1999). In India, social relationships give support through the caste lines (Mishra 2007). The caste system has a significant influence on the coping decisions of farmers. Within the own caste, it is normal to help each other. However, it is not possible to ask money from farmers of another caste. This is especially the cause for other castes with a higher ranking. This limits the possibilities to lend from all the neighbors in the village. Furthermore, in India, there are public organizations where farmers can be a part of, such as Self Help Groups. When a shock has occurred, farmers can fall back on these organizations (Moench & Dixit 2004). If a household can rely on others for help in case of need, the vulnerability of that household is reduced.

3.2.2. Influential factors
As stated before, a lack of knowledge makes it interesting to know which factors have an effect on the choice for particular strategies. These factors are among others related to the social, financial, physical, natural and human capital of the farmers. Various factors can limit farmers' access to coping strategies. Age, education and income can determine whether or not farmers have access to strategies. Older, less educated and poorer farmers probably have fewer possibilities to deal with disasters. According to Dercon (2000), coping with risks through only the income is often difficult for poor farmers. This is mostly the case for old farmers as well. There are several arguments for this statement. Firstly, the poor, the older and the less educated farmers have fewer assets and hence fewer options to give collateral in order to obtain credit. As a result, their borrowing possibilities in times of crisis and their ability to use their assets as a form of self-insurance is limited. That is why Dercon (2000) states that asset-poor households can cope less well with risks. When those farmers would have more diversified assets (for example livestock), they would be better able to spread their risks. Therefore, I expect that the farmers, who have less financial capital such as jewelry and livestock, have fewer coping options and are less able to use specific coping strategies (such as formal borrowing, saving and migrating far away). Furthermore, farmers who own more assets, are better self-insured against disasters. Secondly, the poorer, older and less educated farmers are in more need to use other strategies that have negative long-term consequences (such as borrowing from informal moneylender or take children out of school) in order to cope (Dercon 2000). They have more difficulties to apply less stressful and more profitable coping strategies and cannot easily get other jobs because of their lack of money, education or health. Hence, those farmers have to fall back on more stressful mechanisms. In some cases they do not have access to any strategy at all, so they are bounded to merely reducing their consumption in order to survive. If a household

constitutes of only two old farmers, it is very difficult for this household to deal with a natural disaster. As a result, this household is most likely to mainly reduce the consumption as a coping strategy. Thus, factors such as human capital (age and education) and financial capital (the income of the poor, jewelry,) are interesting to research. Do these factors influence coping decisions of farmers in Tamil Nadu?

I have tried to reason in a logical way and by the experience of my field research in Tamil Nadu, which other factors I expect to have influence on coping decisions. These factors are more related to the social, physical and natural capital: the size of land, the amount of crops that farmers cultivate, whether they cultivate paddy, the area where the farmers live and the household size. First, paddy is an irrigated crop that grows on wet land. It is no drought-resistant crop and therefore it is a more risky crop. Tamil Nadu is a drought-prone state, which makes it more difficult to cultivate paddy than other (more drought-resistant) crops such as pulses. This can have an impact on the coping decisions of farmers, who mainly cultivate paddy. Are they more affected by drought and do they have to use other coping strategies, as a consequence? I think that the land size and the amount of crops cultivated can determine the way farmers deal with disasters as well. Farmers, who have a bigger land size, can get more income from this land (maybe due to returns to scale). At the same time, these farmers are more bounded to their land, because cultivating a big land size takes a lot of time and energy. In addition, a formal bank will be more willing to borrow money to farmers with a bigger land size. More crops can increase the risk diversification and increase food stock, even in times of disasters. If one crop fails completely, another crop might grow and farmers still have some food left. Farmers, who only cultivated one particular crop which cannot yield properly during the disaster, lose all their food at once. Additionally, I expect that the size of the household can influence coping decisions, because households with only one or two members have fewer options to cope. For instance, they do not have the time to work on the farm, work in the house and migrate to another village at the same time in order to earn extra income. Households, which constitute of more members, can delegate the necessary tasks. For instance, one or a few members work on the farm, another works as a wage laborer, one person works abroad, and so on. On the other hand, bigger households need more food and need to find more ways to cope. Perhaps, these households are in more need to use many strategies. Thus, this factor might influence decisions on dealing with disasters. Finally, there are various districts in Tamil Nadu. Some districts face more droughts than others and some districts have more floods, and so on. Therefore, the location could be an important factor for farmers to use particular strategies. Some strategies might not be available or useful in one area while they are very much used in another area. Nilgiris is an area in Tamil Nadu which has a high annual rainfall compared to the other districts. Moreover, it is a hill area which reduces the accessibility to other areas. This could have an impact on the coping strategies of the farmers in Nilgiris compared to farmers who do not live in Nilgiris.

In general, it is more difficult to deal with the consequences of covariate shocks, such as natural disasters. When one household is affected by a covariant disaster, that household probably cannot rely on help from neighbors (Dercon 2000). Farmers might have to put their most valuable assets in danger. Eventually they have to for instance sell or rent out their agricultural land, which is an important productive asset. This type of coping mechanism involves a lot of risk for farmers (Hung 2007). The possibilities of more vulnerable farmers (for instance the less educated, the older, the poorer, the ones who cultivate fewer crops or cultivate mainly paddy) to cope are diminished and an event that is not that 'extreme' can become a serious threat to the livelihoods of farmers. Seasonal droughts and excessive rainfall can already disrupt their daily life (Peters, McCall & Westen 2009).

4 Methodology and data

To identify the ex-post coping strategies, I have first done a literature study. After that, I carried out field research in Tamil Nadu from March until May 2010. The field research has been essential to look at the concrete coping strategies of the farmers in Tamil Nadu. I will first elaborate on my sampling strategy. Thereafter I explain more on how I used the questionnaires, focus groups and extra in-depth question. The empirical model and estimation methods that I have used for this research are explained afterwards.

4.1 Sampling Strategy

In this research, the sampling strategies of the quantitative and the qualitative research were both quota sampling. This was done, because it was very difficult for me to apply random sampling. I did not have a huge list of all the farmers who lived in the area for random selection. I was also limited by the transport and translator options that DHAN Foundation offered. The field work has taken place in seven different areas. It was important to get answers of different farmers from various categories in the population of farmers in Tamil Nadu. In that way, I could research whether or not certain people chose specific coping strategies. Women and men, younger and older farmers, high educated and less educated farmers had to make up a substantial part of the sample. A part of the respondents had to be member of an NGO and a part should not be member of an NGO. Hence, for instance the influence of education, age and NGO membership on the choice of coping strategies could be measured. The research focused on seven different areas on the basis of their climate and soil type. The disadvantage of this strategy is that specific types of farmers might have been excluded in this research. The results can be positively or negatively biased. For instance, higher educated farmers might have been interviewed, because they work less on the land. Or, older farmers are interviewed more often, because they work less and are more at home. All these factors reduce the possibility to generalize the results.

In cooperation with DHAN Foundation, I chose seven districts on the basis of the climatic conditions. These areas were Kottampatti, Theni, Nilgiris, Nattarampalli, Tirumangalam, Mudukulathur and Naggattipattinam. Kottampatti is a black & red soil area where ancient tank systems are running throughout the area. In some villages, DHAN Foundation has set up tank fed programs to renovate the tanks and improve the irrigation possibilities for farmers. Nilgiris is a hill area, which is less affected by drought. The annual rainfall has been very high and at the end of 2009 a big flood has washed away some parts of the land in several villages. Theni is a drought-prone region that suffers from groundwater depletion. Natarampalli is a drought-prone region,n where a large part of the farmers depend on the rain for cultivation. These so-called rain fed farmers cultivat often on red soil. Moreover, this area has a pilot program for crop insurance. Nagappattinam is a coastal area that is more often affected by cyclones (and the tsunami). Nonetheless, drought is also a common problem. Tirumangalam is a black soil rain fed area. In this area, crop insurance pilot programs are active as well. Mudukulathur is a drought-prone area. The climatic conditions in Nilgiris are the most different from the other areas, because it is a hill area and the level of annual rainfall is higher. Therefore, the coping strategies of the farmers in this area probably differ from the farmers in the other areas. On the basis of the seven districts, I have chosen, in cooperation with DHAN, the villages within the

districts. The presence of DHAN Foundation was also a selection criterion of choosing various villages within the areas. DHAN was interested in researching the coping strategies of areas with different living conditions. Examples were rain fed farmers and tank fed farmers, areas with NGOs or agricultural insurance programs and areas without this. Hence, I have tried to interview farmers in villages where DHAN was active and villages where DHAN was not active. In that way, I could look at the influence of NGOs on coping strategies. However, there are many NGOs active all over Tamil Nadu and also in many villages that I have visited (although it was not always DHAN). If some villages worked with DHAN or other NGOs, I have tried to find other villages without NGOs, which was a difficult task. Moreover, the choice of the villages depended on the location as well. If a village was not really remote, I searched for another village that was remote. Per district, two villages per day were visited on average. However, in the districts a varying amount of villages have been visited. In some districts only four villages were visited and in other districts ten villages were visited, because in some districts more days were available to interview than in other districts. This has been caused by the differences in the availability of transport and translators per region. In some regions translators were only available for two days and other regions were so remote that it was more difficult to get there. On average, five farmers per village have been interviewed. Table 1 shows the districts and the amount of farmers interviewed.

Table 1: Amount interviews per region

Region	Amount of farmers
Kottampatti	20
Theni	10
Nilgiris	10
Natarampalli	18
Tirumangalam	40
Mudukulathur	39
Nagappattinam	24
Other	3

4.2 The data collection
4.2.1 Questionnaires
I have used the questionnaires in order to find out what the coping strategies of the farmers in Tamil Nadu were. Moreover, I tried to find the reasons behind the choices for certain strategies. After the first week of testing quantitative questionnaires and extra qualitative questions, I adjusted the quantitative questionnaire. Some questions were too personal or too difficult and the questionnaire was too long. In addition, some strategies were not useful or inappropriate to ask. An example is whether they prayed to God during a disaster. I added other strategies, such as giving jewelry as collateral since it was a commonly used strategy. When the questionnaire was adjusted, the quantitative questionnaires could be answered. The questionnaires have been based on existing articles and literature on coping strategies. I used different articles to get an idea of existing coping strategies. Since many people in rural Tamil Nadu are illiterate, the interviews and questionnaires have been asked by the translators. I explained the translators that it was very important to be objective and accurate in translating and telling what the correct story of the interviewees. In the various areas the pronunciation and meaning of words differed slightly. Therefore, every area had a translator who was familiar with the region, active programs and dialect. I gave the translators information on the purpose of the research and the importance of the way of posing questions. They had to be objective, ask the questions in easy sentences and give farmers the opportunity to state their opinion. This worked out well, because DHAN Foundation is an NGO that works with the farmers themselves. Therefore, the translators, who worked for DHAN, could communicate well with farmers. However, a disadvantage of translating the questionnaires during the interviews is that it still results in a higher loss of information. If the questionnaires would have been translated to Tamil

beforehand and also checked whether the translation was correct, the chances of mistakes due to translation would have been reduced. Since this was not the case, it is not sure whether the translation was really correct. Nonetheless, when questions were answered strangely or the answers were unclear, I told the translator to ask the question in several ways again until I had the idea that the questions were understood (which took a lot of time).

The questionnaire has provided information on the income, the household characteristics (such as assets, livestock and members), the farm characteristics (land, crops) and the natural disasters that they were concerned about. To know what types of strategies are generally used, I have asked the farmers which coping strategies they use by giving seventeen examples of coping strategies (see the appendix). They could mention other coping strategies that were not mentioned in the questionnaire. Per natural disaster, I have asked whether they use one or more of the seventeen given coping strategies. All the farmers have been asked which coping strategies they use specifically during or after a natural disaster. To make sure that those farmers, who already have an off-farm job, use off-farm work as a coping mechanism; I inquired whether they would take extra off-farm work during the disaster. If they would continue the off-farm work as usual, it was not an ex-post coping strategy but regular diversification of the income (ex-ante). This has been done because it is important to know what kind of ex-post coping strategies farmers used (when the disaster already occurred).

 In order to know which disasters farmers face, I have asked which natural disasters concern them. The farmers have been asked whether they are concerned about several natural disasters, ranked from most concerned to least concerned. The three natural disasters that worry them the most, have been taken into account in the questionnaire. Some farmers are only worried about one or two disasters. In total six concerns have been mentioned: drought, pest and disease in crops, pest and disease in livestock, excessive rainfall, flood and cyclones. In total, 143 farmers (87%) have mentioned drought as an important concern. Thus, drought is a main risk. Furthermore, 65 farmers (40%) have stated pest and disease in crops as a concern. Farmers have told that drought causes pest and disease in crops. When drought occurs, pest and disease in crops occurs often as well. Thus, the coping strategies of these two disasters are related. Around 20% is concerned about floods, because they destroy the total yield. The other three disasters have not mentioned often as a concern.

Table 2: Concern disasters

	Drought	Pest & Disease in crops	Pest & Disease in livestock	Excessive rainfall	Cyclone	Flood
N Valid	143	65	18	21	8	32
N Missing	22	100	147	144	157	133

Drought has been stated to happen once a year (60 farmers) or once in two years (26 farmers). Fifty out of the 65 farmers have stated that pest and disease in crops happen every year. For pest and disease in livestock, 8 out of the 18 also mention the yearly return of it. Flood happens once in a year according to 15 out of the 32 farmers. Excessive rainfall only occurs less than once in four years (9 out of the 21 farmers). Farmers have different opinions on the frequency of cyclones. 3 out of the 8 farmers states that cyclones happen every year, while 3 other farmers mention that cyclones occur once in four years. It has been difficult to assess whether the coping strategies that farmers stated to use are only used for that specific disaster they have mentioned. If a farmer had faced a drought and a cyclone in the past, it is possible that he has mentioned all the coping strategies he used for both disasters while answering only the questions related to drought. Thereby the information on cyclones ended up in the drought questionnaire. During the research it has become apparent that farmers mainly have stated to use coping strategies for the disaster, which worried them the most.

Consequently, they did not tell anything about the coping strategies of the other disasters they faced (second or third concern). Hence, the coping strategies got mixed up. Therefore, I have chosen to put all the used coping strategies of the various risks together in separate variables.

Example:
The variables borrow during drought and borrow during a cyclone have become borrow during all the risks. Whereby borrow during all risks is a dummy variable. When someone has not borrowed during a drought, but has borrowed during a cyclone, the dummy variable borrow during all risks =1.

To gain information on the income as an important financial capital, I have asked which crops farmers cultivated, how many kilograms they yielded and how many rupees per kilograms they received. Furthermore, I inquired whether they had sold animals in 2008 or 2009. If their cows gave milk, there was verified for how much money the milk was sold (liters times rupees per liter). A part of the crops grown by farmers were used for own consumption. Especially paddy (rice) was often eaten by the own household. Hence, the farmers did not gain cash from this yield, but it was nonetheless an important source for their livelihood. For non-farm work, the days per year and the amount of rupees per day for the different persons were inquired. Later, I added up the farm-income (from crops, animals), non- farm income (such as wage labor in agriculture or a job in the city), insurance pay outs and remittances. Money from the government (for widows or insurance claims) was added up to the income as well. To check whether the income estimation could be correct, I asked the amount of (golden) jewelry in grams. Eight gram of gold was worth around 15000 rupees. Moreover, I inquired how many cars, motors, refrigerators and livestock the farmers owned. By correlating the amount of jewelry and cars or motors to the income, I verified whether the calculated estimation of the income could be a correct estimation. It became apparent that there was a positive and significant relationship. Hence, I have assumed that the income was estimated correctly.[1] The possession of televisions, bicycles, refrigerators and tractors (that were asked in the questionnaire) were not used to verify the income estimation, because the government of Tamil Nadu gave many households a television or a bicycle for free. Besides that, only four farmers stated to have a tractor and nine famers said to have a refrigerator. Eventually, I have not used the income variable due to reasons explained in the empirical model (paragraph 4.3).

To know more about the financial capital of households, I asked how many televisions, bicycles, cars/motorcycles, refrigerators and grams of golden jewelry they possessed. The latter was a difficult question to ask. Farmers did not want to mention how many grams they possessed because other farmers might want to borrow money from them. This question was therefore mostly asked when as few people as possible were in the neighborhood. For livestock, I asked how many chicken, goats, cows and draft animals they possessed.

Regarding the social capital, I have asked how many members the household contained. Thereafter, I wanted to know who was working on the farm or outside of the farm and who did not generate any income (because they were too young, too old, too sick or other reasons). In India, almost all the female farmers work because the income is needed. In only a few cases, women did not work at all because they were not allowed by their husband. Moreover, old farmers need to work often as well if there is nobody else in the household to raise income. This made it difficult for me to make the

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[1] The correlations of jewelry and motor/cars with the income were positive, the strength of the relationships were medium. The income in 2008 was significantly correlated with jewelry, $r= 0.257$ (p< 0.05) and motors/cars, $r=0.177$ (P<0.05). The income in 2009 was significantly correlated with jewelry, $r= 0.362$ (p< 0.001) and motors/cars, $r=0.266$ (P<0.01).

often used division of independent members (between the age of 15 and 65) and dependent members (younger than 15 years old or older than 65 years).

Another important aspect of social capital in India is the caste system. This determines the status and possibilities of the farmers in the Indian society. During the field research the caste system seemed to have an influence on the choice of coping strategies of the farmers in Tamil Nadu. However, the caste of the farmers was a very sensitive topic. Therefore there was advised not to ask the farmers about it. Consequently, the caste of the farmers could be an important missing independent variable in the model. Hence, correlations and coefficients might have become less strong and not significant because of the underlying effects of castes. However, this is a hypothesis that remains unproven so far.

The land size was an important question to ask in order to know the natural capital. I asked how much land the farmers cultivated in acres and whether they had fallow land. I inquired how much land people possessed and cultivated. The measurement that farmers in Tamil Nadu use is acres.[2] Land that had been sown but was not harvested (for example due to drought) was not considered fallow land. Furthermore, land that was not in use for three months because of crop rotation was also not considered fallow land. Some farmers could not use their land during the dry season. Therefore, their land was only in use for half of the year. This was especially happening in rain fed areas. Some other farmers could not use their land during the monsoon because of heavy rainfall. Therefore, fallow land was considered land that had not been cultivated for at least a year. Moreover, I asked whether the farmers rented in land. Thereafter, the types of crops and the amount of crops were asked. I also wanted to know whether their land was rain fed, and whether they had irrigation or wells. This was important in order to know how much water they could get throughout the year. I asked which crops farmers cultivated in order to know the amount of crops, as natural capital.

I asked question related to human, by asking for the age and education level of the respondents. The education level has been divided into five categories. The first category is illiteracy. The second option was primary school (until the fifth grade). Thereafter was the category until the eighth, ninth or tenth standard (middle school), because many children drop out in this period. The fourth category was the completion of secondary school (twelfth standard). The final category was a bachelor degree or above. This is very high education, which is not normal for farmers in Tamil Nadu. It would have been better if I inquired the education level of all the members in the household, because I would have had the total of the human capital in the household. Still, I think that the education level in a household is (at least partly) correlated. Especially in the richer households, all the members have high education levels. In many households, many members have been going to school until middle or secondary school. The household with illiterate farmers constituted often of a few old farmers. Therefore, I expect that the influence of the independent variable education could be used as an indication of the average family education level.

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[2] One acre of land is around 0.4 hectares.

Table 3 shows all the independent variables, which could be created out of the questionnaire. However, these variables could not all be used. Therefore, I have made assumptions based on literature and my own reasoning. The assumed important independent variables are shown in Table 4.

Table 3: Independent variables

Categories of independent variables	
1. Income and assets:	**3. Farms characteristics**
X=Income per capita X=Ratio (Ratio of agricultural income on total income) X= Agricultural Income X= Income X=Income Difference (Difference income 09 minus 08) X=Income poor (0= > 25000/year, 1=<25000/year) X= Animals X= Jewelry X= Motor/car	X= Amount of members in the household X= Amount of people working X= Amount of people consuming/going to school X= Ratio consuming to working X= Age X= education X=Gender
2. Farm characteristics	**4. Location and NGO**
X=Land (Size of cultivated land) X=Fallow (Size of fallow land) X= Rented in land (Size of rented in land) X= Crops (Amount of Crops) X= Paddy (Main crop is paddy, 0= no/ 1=yes)	X= District (Nilgiris) X= NGO (Member of NGO, 0=no, 1=yes) X= Agricultural insurance (0=no, 1= yes) X= Risk (Experience of any risk, 0=no/ 1= yes

4.2.2 Focus Groups

In addition to the questionnaire, four focus groups were held in order to have discussions and brainstorm sessions. Questions on their coping strategies were asked. I could obtain a general picture on the existing problems and the coping strategies in the villages. Sometimes it was necessary to get specific farmers together in focus groups to ask why they choose specific coping strategies (including microinsurance). In that case, I made a selection of farmers who participated in programs of DHAN Foundation. These programs were related to rain fed programs, tank fed programs and index based crop insurance. In total, I held four focus groups. During the first two focus groups, members of DHAN programs were set together to ask questions related to their problems and coping strategies. The other two focus groups were held with members of the insurance programs and questions related to their insurance and coping strategies were asked in order to see whether the uptake of insurance influenced their choices for other coping strategies. It has been difficult to have a focus group in a structured way. Merely a few farmers were giving the answers and the rest of the group all stated to agree. This is the reason why I only used the information from the focus groups as a basis to ask questions during the interviews and why I have not analyzed the information separately for this research.

4.2.3 Qualitative questions

For qualitative research, it was important to get in-depth answers to the questions from the questionnaire. I asked all the farmers of the quantitative interviews additional questions to gain qualitative results. Besides that, I interviewed two employees of DHAN Foundation to get a better picture of the projects and programs of DHAN and the rural context in Tamil Nadu. During the questionnaires, I asked the farmers questions related to the reasons behind the answers. Therefore, I could give some qualitative comments on the quantitative results in this research in chapter five. In this way, it was also easier to understand why farmers choose certain coping strategies. In merely a survey it would have not known this information. However, the quantitative method has been very useful to look at statistical significance of the answers.

4.3 Empirical model

In order to know the relation between the influencing factors and the coping strategies, an empirical model is given. Why and how do certain factors influence coping decisions? First, I have made assumptions on the impact of income, assets and education on these decisions, mainly from the literature. In addition, through my own reasoning I have made assumptions concerning the other important factors as well. As I mentioned before, this is due to little amount of literature on this topic.

Financial capital matters such as income and assets (jewelry and livestock) are important influential factors that result in choices for specific coping strategies. According to Ding et al. (2003), the income has effect on the coping strategies that farmers use. In general, the poorer farmers have to reduce their consumption during drought (Ding et al. 2003). Richer farmers are assumed to have more positive coping options. They can apply fewer coping strategies which have negative consequences, such as selling productive assets, borrowing from an informal moneylender or taking children out of school. Harrower and Hoddinott also state that during or after disasters, households which are not poor try to find extra work to obtain additional income. At the same time, poor households reduce their consumption, and exchange loans and help (Harrower & Hoddinott 2005).

'Scheduled tribes and scheduled castes, feature prominently amongst the poor in India' (Mishra 2007, p. 181).

Another important aspect of the income could be related to the caste system in India. The poorest people are often part of the lowest castes (scheduled castes). For this reason, the dummy variable 'Income poor' could be a proxy for the lowest caste and perhaps a substantial amount of this group belongs to these lowest castes. This could have a significant effect on their availability of coping strategies. However, this statement is not necessarily true. It is possible that a part of the farmers who have an income lower than 25000 rupees per year are members of other castes. Still, it is important to keep this in mind, for understanding the results of this research. (Around 16.5% of the farmers, that I have interviewed, are among the poorest.)

In addition, farmers with more natural capital such as larger land size and more crops are in general more food secure and in less need to use coping strategies (Khatri-Chhetri 2002). I assume that farmers, who possess a bigger size of land, have to work a lot on the land. During a drought, they will have less time to work off the farm (as a wage laborer or for instance in the city). They might be less affected by disasters and are in less need to fall back on alternative jobs. Small scale farmers might have no other option than to look for alternative employment during disasters. I also reason that by growing more crops, farmers try to spread their risk. In that way, crop diversification might result in income smoothening. During or after a natural disaster they have more probability that some crops can still be harvested and hence they might have more food during or after disasters. Finally, paddy is an irrigated crop and therefore this crop could be more affected by drought. I assume that farmers, who cultivate paddy, are probably more vulnerable and need to use more coping strategies during or after natural disasters.

I think that the amount of members in a household (social capital) has impact on the household's coping decisions. When there are more members, more people can work and this increases the possibility to diversify the income. On the other hand, more food is needed. According to Adekoya (2009), the size of the household influences the food demand. Larger households need to find more additional income sources (Adekoya 2009). When a household has children who go to school or older people who cannot work anymore, it is more difficult to get extra work and gain more income during disasters. Moreover, I think that age and education (human capital) can play a role in the choice of coping strategies. When farmers get older, they have fewer possibilities to use certain strategies. Older farmers have for instance more difficulties to find off-farm work, to pay back borrowed money from others or to rear livestock. Besides that, educated farmers have better possibilities to find

alternative options in cities, because higher qualified employees are needed. Higher educated farmers probably do not need to use many strategies, because they have other non-farm jobs and are less vulnerable when a natural disaster occurs. Hence, they are more secure of their income (Adekoya 2009).

I consider that the varying environment of the seven districts could influence the choice of coping strategies. Varying climatic conditions can affect the occurrence and the impact of disasters as well as on the chosen coping strategies. In addition, perhaps some areas have less access to other villages or cities which reduces for example the opportunities for daily or long-term migration. In Tamil Nadu some districts are more drought-prone and other districts are more flood-prone. Moreover, in some districts there are more pests and diseases. As a result, the farmers in some areas are more vulnerable than farmers in other areas. This can have an impact on their use or their need to use specific strategies.

Out of all the information from the questionnaire, I have chosen ten independent variables that might influence the choice of coping strategies, according to the theory and my own assumptions. These variables were the following: Income of the poor (less than 25000 rupees per year), Age, Education, Jewelry, Livestock, Land, Crops, Paddy, Members, Nilgiris (a hill area In Tamil Nadu, which has a higher annual rainfall than the other areas). The dependent variables of the various coping strategies were used as functions of these ten independent variables. The variable income has not been used since it is an endogenous variable. An instrumental variable would have to be chosen because the income is correlated with the error term. Using the instrumental variable technique can also be problematic and can result in inefficiencies. Instrumental variables estimates are inconsistent if the instruments are correlated with the error term. In addition, weak instruments can be selected. I found it especially interesting to look at factors, other than income (known from literature), that influence coping strategies. Therefore, I have chosen to not include the income variable through estimation by an instrumental variable.

Table four gives the independent variables and the hypotheses. In order to give a structured overview, I gave some general hypotheses. It is not possible to give hypotheses for the ten independent variables on the sixteen dependent variables (coping strategies).

Table 4: Independent variables of the models

No.	Variables	Hypotheses
	The 16 dependent variables are the 16 different coping strategies	
1	Income poor *(Financial capital)*	The really poor farmers have fewer possibilities to cope and have to depend more on consumption reduction (Babatund et al., 2007; Ding et al., 2003).The poor have less access to profitable activities to get higher returns (Dercon 2000).
2	Age *(Human capital)*	Older people have fewer assets, less access to off-farm jobs and hence fewer coping options (Schmidt-Verkerk, 2008). They depend more on reducing their (consumption) costs to cope with disasters.
3	Education *(Human capital)*	More educated people have better job opportunities and hence more income and better savings capacity. Illiteracy or a low education level is often a reason not to migrate (Schmidt-Verkerk, 2008). Wage labor outside of agriculture is often limited to educated farmers (Dercon 2000).
4	Jewelry *(Financial capital)*	Farmers with a higher income and more assets (jewelry, animals) are better able to pay back and hence borrow more (Rweyemamu, Kimaro 6&Urassa, p.3). Farmers with fewer assets are less able to obtain credit (Dercon 2000).
5	Livestock *(Financial capital)*	Farmers with fewer assets have fewer coping options (for example they are less able to obtain credit (Dercon 2000)). Farmers with fewer livestock are often more exposed to income risks. Moreover, they are less able to obtain credit (Dercon 2000).
6	Land *(Natural capital)*	A bigger land size implies often more income (European Commission 2007; Onyebinama and Onyejelem 2010). If farmers have more land, the banks are more willing to borrow money to them because they can give land as collateral.
7	Crops *(Natural capital)*	Farmers who have more crops, spread their risks. However diversification does not always result in income smoothening because all the crops can be affected during natural disasters (Dercon 2000).
8	Paddy *(Natural capital)*	Paddy is an irrigated crop and hence more affected by drought. Thus, farmers who cultivate paddy are more vulnerable and need to apply more coping strategies after disasters.
9	Members *(Social capital)*	The bigger the size of the household, the more food is needed. During natural disasters, the members are in more need to seek other ways of meeting the food need (Adekoya 2009).
10	Nilgiris *(Natural/physical capital)*	Farmers in Nilgiris faced other climatic conditions and the fact that they lived in a hilly area influenced their use of coping strategies.

4.4. Estimation methods

In order to estimate the influence of the ten independent variables on the various coping strategies (the dependent variables), I have used four different models: the Multivariate Probit model, The Linear probability model, The Probit model and the Poisson model. These models were used separately. All the models had the same ten independent variables, but different dependent variables. The dependent variables were the categories of coping strategies for the Multivariate Probit model, the amount of coping strategies for the Poisson regression model and the separate coping strategies for the Linear probability model (LPM) and the Probit model. I will explain these models individually.

Firstly, I have used a Multivariate Probit model. A multinomial Logit regression model is not appropriate for this research because this model can only have one category of the dependent variable (coping strategies) as an outcome. During the field research, farmers stated to use multiple coping strategies to deal with the risks they face. This implies that the outcome should consist more than one category of dependent variables. Therefore, there is chosen to analyze the coping strategies in a Multivariate Probit model. The MV Probit is appropriate for this analysis, because the binary data on coping strategies are correlated. It is important to include this correlation in modeling the data. Hence, extra information can be obtained which is impossible to get with merely Probit or LPM. The MV Probit model has a flexible underlying structure of covariance. Moreover, it is estimated through simulated maximum likelihood (SML) in order to get good properties and efficient estimates. The SML is consistent when the number of observations and the number of draws[3] tend to infinity. The number of draws must be at least equal to the square root of the sample size (in this case, √164= 13). However, when the number of draws is raised with the sample size, simulation bias is negligible. Hence, the more draws there are, the more accurate the results (Cappellari and Jenskins 2003, p.282). Therefore, there has been chosen to raise the number of draws to fifty in this Multivariate Probit analysis.

The advantage of the MV Probit is that the model takes into account the correlations between the various categories. However, the dependent variables (the sixteen coping strategies) are reduced to five categories¸ based on the consequences of the strategies. This results in a loss of information because the influence on the independent variables on the five categories of coping strategies does not provide the full information, which is needed to give a detailed analysis. In order to get additional information, the coping strategies are analyzed separately in LPM and Probit Models. The coefficients and significance levels of the LPM and the marginal effects of the Probit have to be very similar in order to have a robust model.

Firstly, I have analyzed the data through the MV Probit. An increased amount of equations require more observations in order to get consistent estimates. The more equations that are analyzed, the more observations are needed and for this research only 164 farmers have been interviewed. Therefore, I have made categories in order to reduce the amount of equations from sixteen to five. I have chosen to use the combined variables in table 5. The categories are mainly based on the consequences of the coping strategies. Some strategies are more stressful and have more impact or negative consequences on the long term than other strategies. The impact is rated on a scale of one to five, whereby five is the category, which I think has the largest negative impact. The first category includes coping strategies, which do not have a very big impact. By daily migration and wage labor in agriculture, extra money is gained. These strategies do not easily have negative consequences for the farmers. In addition, reducing the consumption is often temporarily. For some farmers it implies eating less during for instance a drought. In that way, they can wait until a better yield next season. For other farmers, it can imply reducing the costs on Hindu festivals. Only, when natural disasters happen continuously, this strategy has a bigger and more negative impact. The second category includes strategies that have more impact than the first category. For long term migration, a households needs to have start-up money and a member migrates for a longer period which has its impact on the household. There is a risk involved because the costs of migrating and the high living expenses can outweigh the benefits of the increased income. By using the savings, the buffer for future shocks is reduced. Loans from friends or family are often small amounts of loans but still require mostly an interest rate (although this is a low rate).

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[3] Draws is the number of random variates drawn when calculating the simulated likelihood. The drawing of random variables from upper-truncated normal distributions is done using a random-number generator combined with the inversion formula (Cappellari and Jenkins, p.282).

The third category has a bigger impact because borrowing from the formal bank implies bigger loans against a higher interest rate, the same holds for giving collateral as a loan. By giving jewelry as collateral, households take a risk of losing for instance their jewelry when they cannot repay loans. Especially in India, this would be a problem since jewelry is needed as dowry for marriages. In that case, a household would have to arrange another loan (probably from an expensive loan from an informal moneylender) to buy new jewelry. Selling luxury goods reduces the buffer stock for future shocks as well. In the fourth category, renting out land and reducing the costs of agriculture have even more negative consequences because the agricultural productivity decreases. By investing less in agriculture, the revenues also decrease. Besides that, the vulnerability against natural disasters can increase. Renting out land decreases the revenue because a fixed amount of rent is paid each month, regardless of the yield. Farmers lose the possibility of increasing their agricultural income during a good season. The fifth category includes the most stressful strategies. Taking children out of school decreases the investment in human capital of the household. The children might for instance be illiterate. It, therefore, reduces the possibilities of finding non-farm work in the future for the children. They will be more limited by working on the farm. Their agricultural knowledge might not be optimal. Taking children out of school eventually increases the vulnerability of the household. Selling livestock, as assets, decreases the diversification of the income. When crops fail, farmers cannot rely on their livestock anymore for daily consumption (milk or eggs for example). Moreover, livestock normally contributes to the agricultural production by assisting in fertilizing or plowing the land. Borrowing from an informal moneylender puts many farmers into huge debts. The interest rate per year often amounts to 80%. When farmers borrow, their loan is almost doubled after only one year. Therefore, these loans cause major problems to farmers. In some cases, I have met farmers who were in such huge amounts of debts that they were never able to repay. In the future, they probably have to give all their belongings to the moneylender and work for him for the rest of their lives.

The main disadvantage of the choice for these categories is that additional information is lost because the coping strategies are categorized together. For instance, the farmers who borrow from the bank and sell luxury goods have been analyzed together in category three. This could result in a loss of valuable information on the different types of farmers. Nonetheless, the importance of a MV Probit Model outweighs the disadvantages of the categorization. That is, taking into account the underlying correlations can give valuable information. I have tried to compensate the loss in information by analyzing the coping strategies one by one through the LPM and Probit models.

Table 5: Categories of dependent variables

Category	Impact	Independent variables
Category 1	1	Daily migration, Wage labor in agriculture and Reduce costs of consumption.
Category 2	2	Long-term migration, Using saved money, Borrow friends and family.
Category 3	3	Borrow from formal bank, Give collateral as a loan and Sell luxury goods.
Category 4	4	Rent out land and Reduce costs of agriculture.
Category 5	5	Take children out of school, Sell livestock and Borrow from moneylender.

Next to the MV Probit, I have used the Linear probability Model to get obtain all the information on the sixteen separate coping strategies. However, this analysis does not take into account the underlying correlations (like the MV Probit does). For the analyses the LPM is used, because there are some advantages of this model compared to the Probit model. Firstly, the coefficients can be interpreted immediately. (However, the coefficients of the independent variables have a constant

effect.) In the Probit Model, the middle values have a stronger effect than the larger positive and negative values. Nonetheless, the larger values of variables such as education, age (the very old), land size (very small or very big land) and income (very poor) are very important for this research. It is hypothesized that very poor or very old farmers have fewer opportunities to use coping strategies. Therefore the LP model is preferred and the estimators of LPM are unbiased and consistent. The disadvantage of this model is firstly the problem with heteroskedasticity. When there is no constant variance, OLS does not provide estimates with the smallest variance. Hence, observations with larger error terms get more weight and standard errors are biased. Secondly, the probabilities of the predicted y can be lower than zero or higher than one. Thirdly, the R^2 is generally low. In a Probit model there is a Pseudo R^2 (Pyndick& Rubinfeld 1998).

In addition to the LPM, I have also used the Probit model to force the range of probabilities of y between zero and one. However, the coefficients could not be interpreted directly and the marginal effects had to be calculated. To compute these marginal effects, the means of the independent variables have been used. The marginal effects change with the changing values of the independent variables. In that way, I have also checked whether my model is robust. If the coefficients (and significance levels) of the LPM and the marginal effects of the Probit model are relatively similar, the model is robust. For a Probit model, the Maximum likelihood Estimation tries to pick the values of the model parameters that made the data 'more likely' than any other values of parameters would make them. This non-linear model is used to maximize the probability of observing the gathered data points.

Table 6: The Probit model

The statistical distribution f is a normal distribution. $P_i = F(\alpha + \beta X_i) = F(Z_i)$ $Z_i = \alpha + \beta X_i$ P_i = a transformation of $\alpha + \beta X_i$. P_i *will lie in the* interval [0, 1]. It represents the probability of using the specific coping strategy. Y= 1 (the farmer uses the specific coping strategy) if $Z_i > Z_i^*$ Y=0 (the farmer does not use the specific coping strategy) if $Z_i < Z_i^*$. The Probit model assumes that Z_i^* is a normally distributed random variable

Z_i is a theoretical continuous index determined by independent variable X. Hence, there are no observations on Z_i. The data only distinguish whether the separate observations belong to one category (high Z_i values) or the other category (low Z_i values). Hereby Z_i^* is the critical cut-off value to choose between Y=0 (not using a coping strategy) and Y=1 (using the coping strategy).
When the regression coefficient of the independent variable (x) is negative, it decreases the probability of the outcome of y (the coping strategy). The Probit regression assumes that the error terms are independent. Therefore, each observation needs to be independent. For this research I have collected independent observations of 164 farmers by interviewing the farmers one time and separately. Furthermore, Probit regressions require larger sample sizes than Ordinary Least Squares regressions. At least ten observations per independent variable are needed. Since N=164 and the amount of independent variables in the model does not exceed ten, this condition is satisfied (Pyndick & Rubinfield 1998).

In addition to the LPM and Probit Model it is interesting to know whether the ten independent variables influence the amount of coping strategies which the farmers use to cope with natural disasters. The Poisson regression is used, because it is appropriate to model count data. It is a useful analysis, because the dependent variable is a count of events, in this case of the use of strategies to

cope. The events must be independent. That is to say, the use of one strategy will not make another more or less likely. The Poisson regression assumes that the dependent variable has a Poisson distribution. Moreover, it is assumed that the logarithm of the expected value of Y can be modeled by a linear combination of unknown parameters (Log($E(Y|x))$=a + bx). A Poisson regression on the amount of coping strategies, without insurance, (NI=No Insurance) has been done. Agricultural insurance is an independent variable (whether a farmer was insured or not) and a dependent variable (a coping strategy). Therefore, agricultural insurance is not taken into account in this model.

5 Results

In this chapter I elaborate on the results. Some basic information on the farmers, the independent variables and the coping strategies is shown. Next, the interdependent relationships of coping strategies and the relations with NGO membership and agricultural insurance uptake are given. Thereafter, the results of the MV Probit, LPM, Probit model and Poisson regression are given and the analyses thereof are discussed.

5.1. General information
There are various types of farmers, but the average age of the respondents is 45.26. The average amount of farmers working in a household is 2.57 and the average of farmers who are not working is 1.75. Housewives are not regarded as working members. Almost all the women worked on the farm, for a government scheme or as a wage laborer. Only a few women were not allowed to work. The working members included for instance children who worked or also households with only two very old farmers (older than 65), who had to work on their land because they did not have another option. The average amount of land that farmers cultivate is 2.72 acres (around one hectare). On this land they cultivate on average 2.5 different crops. The average income per household in the year 2009 was 88886 (around 1560 euro per year) and per capita this was 23939 rupees (around 420 euro per year). This means that they live on average around the poverty line of one euro per day.
Table 7 provides information on the ten independent variables that I used for the models.

Table 7: Summary of independent variables

Variable	Observations	Mean	Standard Deviation	Min	Max
Income poor	164	0.164	0.372	0	1
Age	164	45.256	12.874	18	72
Education	164	2.396	1.117	1	5
Jewelry	164	41.884	53.036	0	450
Livestock	164	4.737	7.197	0	50
Land	164	2.721	2.821	0	20
Crops	164	2.493	1.434	1	8
Paddy	164	0.366	0.483	0	1
Members	164	4.326	1.889	1	15
Nilgiris	164	0.061	0.240	0	1

Table 8 shows the average use of the coping strategies per district and on average. The particular coping strategies are highlighted if they are used by more than fifty percent of the farmers in an area.

Table 8: Coping strategies per district compared to the average

	Kotam patti	Nataram palli	Nilgiris	Muduku lathur	Tiruman galam	Nagapp attinam	Theni	Average
Insurance	0.05	0.17	0	**0.64**	0.3	0.46	0.10	0.32
Sell Livestock	0.45	0.39	0	0.31	0.55	**0.54**	0.40	0.41
Formal Bank	0.10	0.06	0.10	0.05	0.03	0.21	0.40	0.12
Rent out Land	0.20	0.06	0.10	0.10	0.03	0.04	0	0.07
Wage labor agriculture	**0.80**	**0.67**	0.40	**0.62**	**0.68**	0.29	**0.60**	**0.60**
Government	0	0	0	**0.64**	0.05	**0.92**	0	0.30
Collateral	0.50	0.39	0.20	0.38	0.25	0.46	**0.60**	0.39
Luxury Goods	0	0.22	0.1	0.13	0.1	0.29	0.2	0.15
Long migration	**0.55**	0.33	0	0.15	0.1	0	0	0.16
Daily migration	0.35	0.33	0	0.05	0.18	0.04	0.2	0.16
Reduce Agr. costs	**0.95**	**0.67**	0.7	**0.69**	**0.73**	0.38	0.5	**0.67**
Out School	0.25	0.17	0	0.15	0.03	0	0.3	0.11
Reduce consumption	0.35	**0.67**	0.7	**0.82**	0.8	**0.79**	0.6	**0.71**
Saved money	0.05	**0.72**	0.4	0.15	0.35	0.17	0.6	0.30
Moneylender	**0.6**	0.44	0.3	0.31	0.25	0.46	0.2	0.35
Borrow friends	1	**0.67**	0.2	**0.54**	0.8	**0.54**	0.3	**0.57**

On average, reducing the costs of agriculture and consumption are often applied strategies. Reducing the costs of agriculture is not common in Naggappatinam and Theni. Wage labor in agriculture and borrowing from friends and family are common coping mechanisms of farmers in Tamil Nadu. However, in Nilgiris and Theni only a small part of the farmers borrows from friends and family. (It has to be mentioned that only ten farmers have been interviewed in both districts.) In addition, wage labor in agriculture is not a common strategy in Nagapattinam and Nilgiris. In this region, livestock is often sold in order to cope. Renting out land and taking children out of school are rare strategies. Furthermore, Nagappattinam and Mudukulathur are more supported by the government than on average. Mudukulathur receives help from the government through a crop insurance program and Nagappattinam through post-cyclone pay outs. The coping strategies used in Nilgiris differ a lot from the average used coping strategies. Nobody sells livestock, receives government help or agricultural insurance, takes their children out of school or migrates (long term or daily) as a coping strategy. Since Nilgiris is a hilly area, it could be difficult for farmers to go to another village for an off-farm job (outside of agriculture). In addition, the area is not as affected by drought as other areas. Thus, the farmers in Nilgiris need to use fewer stressful coping strategies.

In order to investigate whether certain coping strategies are often used in combination with other coping strategies, the cross tabulations between all the sixteen coping strategies are analyzed. Only the combinations with a significant Chi^2 are given below.[4]

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[4] Otherwise a table of 16 * 16 = 256 strategies has to be shown, whereby many Chi^2 will be insignificant.

Table 9: Interdependent relationships of coping strategies [5]

Combinations		Chi^2	P-Value	Sign
Wage labor agriculture &:				
	Moneylender	3.997	0.046	+
	Selling livestock	3.719	0.054	+
	Help government	6.988	0.008	-
	Saved Money	4.597	0.032	-
	Daily migration	14.030	0.000	+
	Take children out school	6.875	0.009	+
	Reduce agricultural costs	10.630	0.001	+
	Long migration	8.322	0.004	+
	Collateral	3.084	0.079	+
Take children out of school &:				
	Moneylender	8.666	0.003	+
	Sell luxury goods	2.796	0.094	+
Reduce agricultural costs &:				
	Help government	6.212	0.013	-
	Selling livestock	3.305	0.069	+
	Reduce consumption	5.748	0.017	+
Daily migration &:				
	Help government	5.433	0.020	-
	Borrow from friends	5.845	0.016	+
	Agricultural insurance	4.527	0.033	-
Long migration &:				
	Help government	3.500	0.061	-
	Borrow from friends	5.845	0.016	+
	Moneylender	13.853	0.000	+
Collateral &:				
	Formal Bank	10.849	0.001	+
	Selling Livestock	4.11	0.036	+
Help Government &:				
	Saved money	4.844	0.028	+
	Agricultural insurance	59.602	0.000	+
Reduce consumption &:				
	Borrow from friends	3.474	0.062	-
	Saved money	3.070	0.080	-
	Rent out land	5.576	0.018	-
Formal Bank &:				
	Moneylender	3.603	0.058	+

As shown in this table, wage labor in agriculture is positively interrelated with many other coping strategies (such as borrow from informal moneylender, selling livestock, daily migration, taking children out of school, reducing agricultural costs, long migration and giving collateral for a loan) because it is the most commonly used strategy. These strategies complement wage labor in

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[5] To verify whether the interdependent relations were positive or negative, cross tables have been checked.

agriculture (or the other way around). However, wage labor in agriculture is negatively related with getting help from the government and using saved money. They are substitutes for wage labor in agriculture. This could be due to the fact that having saved money or getting help from the government reduces the need to find wage labor in agriculture (The real causality remains unclear however.) Taking children out of school is a complementary strategy to borrowing from moneylenders and selling assets as a last resort. Reducing consumption and selling livestock complement the strategy of reducing agricultural costs and government help is a substitute for reducing the costs of agriculture. When farmers receive help from the government, they probably are in less need to reduce the costs. Besides that, daily migration is a complement to borrowing from friends. Government help and agricultural insurance are substitutes for daily migration.

Migrating for a longer term is a complement to borrowing money from a local moneylender or friends, because money is needed to pay for the start-up costs. Government help is a substitute to long-term migration, but also here the causality is unclear. Giving collateral for a loan is complementary to borrowing from a formal bank and selling livestock. Perhaps farmers use these strategies together, because access to one strategy increases the probability to have access to the other strategy. Reducing consumption is a substitute for using saved money, borrowing from friends and renting out land. The more savings are used, money is borrowed from friends or land is rented out, the less consumption reduction is needed and the other way around. This shows that reducing consumption is a last resort. It is a coping strategy for farmers who have no other possibilities to cope with natural disasters. It also shows that farmers often use more strategies together to deal with the problems. Finally, when government help is received or farmers have agricultural insurance, there is less need to use some specific strategies such as wage labor in agriculture, reduce agricultural costs and daily migration. (Or the other way around: when those strategies are applied, farmers do not need/receive government help or agricultural insurance.)

Furthermore, I found it interesting to know whether being member of an NGO or having agricultural insurance influenced the decisions to apply other strategies. Perhaps, the help of an NGO or having agricultural insurance reduces the need to use stressful strategies such as borrowing from an informal moneylender or selling productive assets. Or maybe it stimulates farmers to save money. Therefore, I have used the cross tabulations between NGO and the other coping strategies. Only savings, formal bank and insurance turn out to have a significant Chi ^{2}. This positive interdependence is logical because NGOs provide savings options, formal loan possibilities and agricultural insurance.

Table 10: Interdependent relationships with NGO

Correlations	Chi^2	P-Value	Sign
NGO and Saved Money	5.372	0.020	+
NGO and Formal Bank	3.689	0.055	+
NGO and Agricultural Insurance	4.101	0.043	+

To verify whether agricultural insurance is interdependently related with the use of coping strategies, the cross tabulations between agricultural insurance and the other coping strategies are used as well. Only government help, NGO and daily migration turn out to be significant. NGOs and the government provide agricultural insurance in Tamil Nadu. However, the negative interrelation between insurance and daily migration is interesting. Farmers who migrate daily might need agricultural insurance less or agricultural insurance leads to less daily migration as a coping strategy. The causality remains unclear.

Table 11: Interdependent relationships with agricultural insurance

Correlations	Chi^2	P-Value	Sign
Agricultural Insurance and NGO	4.101	0.043	+
Agricultural Insurance and Daily Migration	4.527	0.033[6]	-
Agricultural Insurance and help government	59.602	0.000	+

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[6] The interdependence between agricultural insurance and daily migration is negative. This was checked through cross tables.

5.2 Determining the coping strategies

5.2.1 Multivariate Probit Analysis

Table 12 gives the output of the MV Probit regression of the five categories (see Table 11) as dependent variables and Income poor, Age, Education, Jewelry, Livestock, Land, Crops, Paddy, Members and Nilgiris as independent variables. I have also added the categories again, in order to be able to understand the table.

Table 12: Multivariate Probit regression on coping strategies

Category	Independent variables
Category 1 N= 145	Daily migration Wage labor in agriculture Reduce costs of consumption
Category 2 N= 122	Long-term migration Using saved money Borrow friends and family
Category 3 N= 81	Borrow from a formal bank Give collateral as a loan Sell luxury goods
Category 4 N= 115	Rent out land Reduce costs of agriculture
Category 5 N= 101	Take children out of school Sell livestock Borrow from moneylender

N=164 Draws=50	Category 1 N=145	Category 2 N=122	Category 3 N=81	Category 4 N=115	Category 5 N=101
Income poor	0.661	-0.301	-0.132	0.167	-0.491
	(0.544)	(0.333)	(0.310)	(0.307)	(0.328)
Age	-0.007	-0.024	0.005	-0.007	-0.007
	(0.013)	(0.011)**	(0.009)	(0.009)	(0.010)
Education	-0.244	0.216	0.234	-0.074	0.172
	(0.135)*	(0.122)*	(0.106)**	(0.104)	(0.114)
Jewelry	-0.004	0.0003	0.006	-0.0009	-0.007
	(0.002)*	(0.003)	(0.003)*	(0.002)	(0.003)**
Livestock	-0.012	-0.030	0.003	0.004	0.123
	(0.020)	(0.018)*	(0.014)	(0.016)	(0.035)***
Land	-0.057	0.022	-0.019	0.019	-0.060
	(0.047)	(0.051)	(0.044)	(0.041)	(0.053)
Crops	0.137	0.288	-0.046	0.059	-0.074
	0.127)	(0.107)***	(0.074)	(0.079)	(0.084)
Paddy	-0.219	0.104	0.475	-0.053	-0.025
	(0.329)	(0.268)	(0.231)**	(0.234)	(0.248)
Members	0.053	0.026	0.097	0.096	0.095
	(0.085)	(0.070)	(0.059)*	(0.066)	(0.071)
Nilgiris	-0.714	-1.144	-0.796	0.077	-0.933
	(0.528)	(0.503)**	0.502	(0.473)	(0.491)*
Constant	2.144	0.691	-1.386	0.419	0.162
	(0.877)**	(0.735)	(0.618)**	(0.638)	(0.682)

Standard errors in parentheses
* Significant at 10%; ** significant at 5%; *** significant at 1%

5.2.2 Analysis of MV Probit

De coefficients of the MV Probit cannot be interpreted directly. Merely, the directions of the coefficients (positive or negative) in this model are relevant. It is difficult to mention the magnitude of the effects of the independent variables, so I will only mention whether the independent variables result in an increased or decreased probability of using a category of coping strategies.

Category 1: *daily migration, wage labor in agriculture and reduce the costs of consumption.*

The model suggests that an increase in human capital and financial capital decrease the chance to use this category to cope. Farmers who are higher educated, have less probability to apply this category of coping mechanisms. Higher educated farmers have in general a higher income, because they have more often non-farm jobs, which pay a higher salary. When a disaster occurs, they are not as much affected as less educated farmers (who depend more on income from agriculture). As a result, they are in less need to work as wage laborer in agriculture (this is not their working area) or migrate daily (probably they already work in another city else and do not need to find extra work somewhere else). Furthermore, they do not have to fall back on reducing the costs of consumption because they still have sufficient income. Farmers, who own more jewelry, have a decreased probability to apply this category as well. Farmers with more assets have other coping options. For instance, they can more easily borrow some money or sell some of their assets. Therefore, traveling daily to the city for work or working as a wage laborer is not as necessary for them. Farmers, who do not possess much jewelry, have to find other ways of obtaining extra money to smooth their consumption. They are more often inclined to search for these jobs. In addition, they will more easily reduce their consumption, because they cannot sell assets to keep their consumption on the same level as before the disaster happened.

Category 2: *long-term migration, using saved money and borrow friends and family.*

An increase in human and natural capital increases the probability to use this category. Older farmers have a decreased probability to use these coping strategies because they are more limited in their coping options. In general, they do not have a lot of savings, because they are too old to earn a lot. When a disaster occurs, they do not have savings to smooth consumption. Long-term migration is very difficult because of their reduced health condition and the lack of money for the 'start-up costs' of migration. Since they do not have a lot of money and have fewer possibilities to earn extra money, they will not be able to pay back the money, which they have borrowed. Therefore, they will not easily borrow from friends and family (and friends will probably not easily borrow to them). In general, farmers, who have a higher education level, earn more and have more savings to use after or during a disaster. They possess more money to pay for the costs to send a member abroad or to another city. These jobs also require educational skills and are, therefore, only available to higher educated farmers. Regarding borrowing from friends, it is easier for higher educated farmers to borrow money, because they can pay it back in the future when their income has increased again. Farmers, who own more livestock, have more assets and are maybe richer farmers. They have less probability to migrate for a long-term, because rearing livestock is a time-consuming activity that needs to be done every day of the year. As a result, those farmers have fewer possibilities to move away for a few months (or longer). It is probably not even necessary for them to migrate for a longer period. Since they have sufficient assets (livestock) they might not need to use their saved money or to borrow from family and friends and they are more likely to be able to cope on their own. During a drought, the livestock can still get food by eating the dried out crops, which people cannot eat anymore. Moreover, cows can give milk and chicken produce eggs. As a result, they more easily have sufficient food intake.

Farmers, who cultivate more crops, often have a bigger size of land and can eat more varieties of food from their own land. This gives them more possibilities to save money (it does not need to be spent on food). During a disaster, they can use this saved money. Moreover, they often depend more on agriculture for their income. When a disaster occurs, they might be more easily affected and need to borrow some extra money to cope. Thereby, I would say that they have fewer possibilities to

migrate for a longer period (more crops implies generally that farmers own more land and have less time to work somewhere else). However, the results suggest that farmers who own more crops have more probability to migrate for a longer period. Farmers in Nilgiris, live in a hill area, which has less access to other areas. Therefore, it is more difficult for them to migrate to another place. Besides that, this area has a higher annual rainfall and the crop yield is very high compared to other districts in Tamil Nadu. As a result, they have fewer problems due to natural disasters and hence they are in less need to apply coping strategies. This could be a reason that farmers in Nilgiris do not have to migrate for a longer period. Moreover, they are in less need to use their savings to cope (although they probably have enough savings) and do not have to borrow money from family and friends.

Category 3: borrow from a formal bank, give collateral as a loan and sell luxury goods
An increase in financial, social and human capital, increase the probability to apply this category in order to cope. Farmers, who are better educated, have often more income from non-farm jobs. Since they have better jobs and more income they have more assets. This is why they have more chance to sell luxury goods or give assets as collateral for a loan. Thereby, banks are more willing to lend them money, because banks only borrow money to farmers, who have sufficient income and assets. Farmers, who posses more jewelry have in general more income. They have more options to sell this jewelry as well, in order to smooth their consumption after or during a disaster. In addition, they can give the jewelry as collateral to get a loan. The formal bank provides loans to farmers, who have more income (and have more jewelry).
Farmers, who mainly cultivate paddy, receive more help from the NGOs and the government in Tamil Nadu. These NGOs help them by obtaining group loans from the formal bank. It is, therefore, easier for these farmers to borrow from a formal bank in order to cope. In addition, those farmers who are able to cultivate paddy properly, often have a well or another irrigation system. This implies that they have enough money to irrigate their paddy. The part of the paddy cultivators, which is able to irrigate paddy, is richer and has more assets to sell or give as collateral for a loan. At the same time, paddy cultivators who do not have a well, are more vulnerable to droughts and have to fall back on these strategies more quickly. Bigger households are more likely to borrow from the formal bank to cope. These households can better diversify their income, because (in general) more members are able to work and it is also easier for them to send a member to the city or abroad. Since they can earn more, they probably also have more assets to give as collateral for a loan or to sell in order to cope with natural disasters.

Category 4: rent out land and reduce costs of agriculture
After the MV Probit has been done, it appears that no independent variable has a significant effect on the use of this category of coping strategies. Perhaps, the Linear probability Model and the Probit Model can provide more information on these two coping strategies separately.

Category 5: take children out of school, sell livestock and borrow from moneylender
An increase in natural capital decreases the chance to use this category of strategies to cope. An increase in financial capital has a positive effect (through the impact of livestock) and a negative effect (through the impact of jewelry) on applying this category of strategies.

Farmers, who possess more livestock, are more likely to sell their livestock as a coping strategy. If farmers have livestock, they have the possibility to sell it in order to obtain additional income and smooth their consumption. Farmers, who do not possess livestock, simply cannot use this strategy. Owning livestock increases the probability to borrow from an informal moneylender to cope. The animals might get also affected by disasters and farmers need additional money to save their animals. Some farmers have stated that livestock can get diseases by for instance droughts. Farmers perhaps need more money from the moneylender to buy feed for the livestock. Moreover, farmers who own more livestock are more likely to take their children out of school. It is difficult to reason why this could be the case. Perhaps those farmers depend more on agriculture and livestock and,

therefore, need their children to help out on the farm. During the research, I met children who were taken out of school and they often had to work in non-farm jobs (for instance cotton mills). Therefore, it could be that in this model, the effect of livestock on selling livestock and borrowing from an informal moneylender outweigh the effect on taking children out of school. Whether this is really the case, remain unknown. Farmers, who own more jewelry, are often richer. They are less inclined to fall back on stressful coping mechanism, which have negative consequences in the long run. These farmers will more often borrow from the formal bank or give jewelry as collateral in case they really need extra money. Richer farmers (who possess more jewelry) look more often for extra employment as well, if they need some additional income to compensate the loss caused by disasters. Poorer farmers, who own fewer assets, cannot rely on these mechanisms and need to apply other strategies. Farmers, who live in Nilgiris, have fewer problems regarding droughts. They only face seasonal excessive rainfall. The farmers, who cultivate crops in this area, have very good yields and also have a high income. Many farmers in Nilgiris produce cash crops as well. When they face natural disasters (in this case, mainly excessive rainfall or floods), they are not as affected as farmers who face a drought in a drought prone area. Thus, the farmers in Nilgiris have more income and they are less affected by disasters. Therefore, the often do not need to apply this category of stressful coping strategies.

5.2.3 LPM and Probit Model
Table 13: Linear probability Model on coping strategies

N=164	(1) Borrow friends N=93	(2) Money Lender N=58	(3) Saved money N=50	(4) Reduce consumption N=117	(5) Out school N=18	(6) Reduce Agr. Costs N=110
Income poor	0.020	-0.183	-0.061	-0.091	-0.039	0.100
	(0.110)	(0.109)*	(0.103)	(0.100)	(0.073)	(0.111)
Age	-0.008	-0.001	-0.003	0.008	0.001	-0.003
	(0.003)**	(0.003)	(0.003)	(0.003)***	(0.002)	(0.003)
Education	0.083	-0.003	0.051	-0.069	-0.033	-0.041
	(0.037)**	(0.037)	(0.035)	(0.034)**	(0.024)	(0.037)
Jewelry	-0.000	-0.001	0.000	-0.001	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Livestock	-0.005	0.013	-0.002	-0.006	0.003	0.002
	(0.005)	(0.005)**	(0.005)	(0.005)	(0.004)	(0.005)
Land	-0.007	-0.033	0.034	-0.012	0.007	0.009
	(0.015)	(0.015)**	(0.014)**	(0.014)	(0.010)	(0.015)
Crops	0.021	0.000	0.028	-0.044	-0.005	0.025
	(0.027)	(0.027)	(0.026)	(0.025)*	(0.018)	(0.028)
Paddy	0.086	0.059	-0.085	-0.043	-0.018	-0.036
	(0.084)	(0.083)	(0.079)	(0.077)	(0.055)	(0.084)
Members	0.019	0.022	-0.026	0.019	0.033	0.027
	(0.021)	(0.021)	(0.020)	(0.019)	(0.014)**	(0.021)
Nilgiris	-0.483	-0.057	0.055	-0.004	-0.080	0.102
	(0.168)***	(0.165)	(0.157)	(0.153)	(0.110)	(0.168)
Constant	0.642	0.383	0.318	0.645	0.014	0.744
	(0.223)***	(0.220)*	(0.209)	(0.204)***	(0.147)	(0.224)***
R^2	0.149	0.110	0.138	0.149	0.070	0.045

N=164	(7) Daily migration N=27	(8) Long migration N=27	(9) Luxury goods N=24	(10) Collateral N=64	(11) Government help N=49
Income poor	0.164	-0.128	0.022	-0.007	-0.224
	(0.086)*	(0.084)	(0.081)	(0.109)	(0.092)**
Age	-0.005	-0.005	0.007	-0.001	0.005
	(0.003)**	(0.003)*	(0.002)***	(0.003)	(0.003)*
Education	-0.021	-0.027	0.065	0.034	0.017
	(0.029)	(0.028)	(0.027)**	(0.037)	(0.031)
Jewelry	-0.001	0.001	0.000	0.002	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)**	(0.001)
Livestock	-0.003	-0.005	-0.000	-0.000	0.007
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Land	0.003	-0.024	0.011	0.001	0.002
	(0.012)	(0.012)**	(0.011)	(0.015)	(0.013)
Crops	0.005	0.012	-0.030	-0.028	-0.046
	(0.021)	(0.021)	(0.020)	(0.027)	(0.023)**
Paddy	-0.074	0.002	0.007	0.141	0.470
	(0.066)	(0.064)	(0.062)	(0.083)*	(0.070)***
Members	0.004	0.019	0.013	0.052	-0.027
	(0.016)	(0.016)	(0.015)	(0.021)**	(0.018)
Nilgiris	-0.184	-0.287	-0.057	-0.233	-0.137
	(0.131)	(0.127)**	(0.123)	(0.165)	(0.140)
Constant	0.472	0.420	-0.332	0.085	0.118
	(0.174)***	(0.170)**	(0.164)**	(0.220)	(0.187)
R²	0.074	0.125	0.102	0.145	0.303

N=164	(12) Wage labor agriculture N=99	(13) Rent out land N=12	(14) Formal Bank N=19	(15) Sell livestock N=68	(16) Agricultural Insurance N=53
Income poor	-0.007	0.016	0.049	-0.171	-0.225
	(0.107)	(0.060)	(0.074)	(0.099)*	(0.096)**
Age	-0.011	-0.003	-0.000	-0.001	0.000
	(0.003)***	(0.002)*	(0.002)	(0.003)	(0.003)
Education	-0.099	0.029	-0.010	0.078	-0.051
	(0.036)***	(0.020)	(0.025)	(0.033)**	(0.032)
Jewelry	-0.001	0.000	0.001	-0.001	0.001
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Livestock	0.003	0.000	-0.001	0.030	0.018
	(0.005)	(0.003)	(0.004)	(0.005)***	(0.005)***
Land	-0.020	0.004	0.002	-0.012	0.021
	(0.015)	(0.008)	(0.010)	(0.014)	(0.013)
Crops	0.060	0.006	0.033	-0.005	0.006
	(0.027)**	(0.015)	(0.018)*	(0.025)	(0.024)
Paddy	-0.031	0.104	0.129	0.010	0.328
	(0.082)	(0.045)**	(0.057)**	(0.075)	(0.073)***
Members	0.013	-0.002	-0.008	0.010	-0.045
	(0.020)	(0.011)	(0.014)	(0.019)	(0.018)**
Nilgiris	-0.202	0.037	0.056	-0.392	-0.105
	(0.163)	(0.091)	(0.113)	(0.150)**	(0.145)
Constant	1.231	0.075	0.022	0.236	0.338
	(0.217)***	(0.121)	(0.150)	(0.201)	(0.194)*
R-squared	0.176	0.097	0.076	0.306	0.280

Standard errors in parentheses.* Significant at 10%; ** significant at 5%; *** significant at 1%

5.2.4 Analysis of LPM and Probit model

The quantitative analysis is given on the basis of the coefficients of the Linear probability model. Nonetheless, the marginal effects and the significance levels of the Probit model do not differ too much. The fact that the two models have similar outcomes implies that the estimations are robust. If the Probit model provides additional information, this is also given below. The LPM and the Probit model give additional in-depth information. For instance, if an independent variable has a positive effect on getting an extra job to gain additional income according to the MV Probit model, I could verify this information through the LPM and the Probit model and also show which loan is especially positively influenced by that particular independent variable. Next to this quantitative analysis, I will give some reasoning's behind the outcomes in this paragraph. The reasons for farmers in Tamil Nadu to use different strategies to cope with natural disasters vary a lot. It has become apparent that farmers have various reasons for choosing the same strategy or not choosing that strategy. A very poor farmer states for instance not to borrow because he cannot pay back. (He has no *option* to borrow.) A richer farmer states not to borrow because he does not need to. (He *chooses* not to borrow.) In that case, both farmers do not borrow for the opposite reasons. Therefore, this paragraph elaborates also on the reasoning behind the decisions of the farmers in Tamil Nadu as well.

Borrow from family and friends

An increase in the age of farmers with twenty years decreases the probability of taking a loan from family and friends with 16 percentage points. Older farmers have more difficulties to gain income and are, therefore, less able to pay back their loans. They do not want to borrow and friends and family also might not want to borrow to them. An increase in education level with one increases the probability to borrow from friends and family with 8 percentage points. Loans from friends and family are often only small loans. Perhaps more educated farmers are not that much affected by disasters and a small loan from friends is sufficient. Farmers, who live in Nilgiris have (compared to farmers who do not live in Nilgiris) 48 percentage points less probability to borrow from friends. They do not need as much loans to cope, because farmers in Nilgiris have a higher annual rainfall and better yields. Hence, they can manage better on their own.

Borrowing from friends or family during droughts is done very often in Tamil Nadu. These are mostly very small amounts (2000 or 3000 rupees) to cover the most immediate expenses. However, some farmers mention that friends and family have the same problems as they have, due to for instance drought. Hence, they cannot borrow from them. Besides that, some farmers do not want to ask for money from relatives or family, because they would never give them a loan. Here, the caste system and prestige might have played a role. Higher castes feel 'too good' to ask for a loan or to lend money to others. Whether this is truly the case, remains unknown since it is not clear which farmers belong to what caste. Very poor farmers, older farmers or single adult households often do not want to take any loan because they would never be able to repay. At the same time, richer farmers do not always need to borrow necessarily.

Informal moneylender

Farmers, who earn less than 25000 rupees per year, have 18 percentage points less probability to borrow from an informal moneylender. The really poor farmers cannot pay back the interest. It is also possible that the poorest part of the farmers is a proxy for the lowest caste (scheduled caste). In that case a big part of the poor are member of the lowest caste and the moneylenders (who are always of higher castes) are not willing to lend to this lowest caste. An increase in the amount of livestock with ten raises the probability that farmers borrow from informal moneylenders with 13 percentage points. Perhaps, livestock is also affected by the disasters and more money is needed to maintain them. In that case, more money is borrowed from the informal moneylender. An increase in the amount of land with five acres decreases the probability to borrow from an informal moneylender with 16 percentage points. If farmers have more land, the banks are more willing to

borrow money to them because they can give land as collateral. Farmers with more land can better repay as well, because they probably have more income. It is therefore less necessary for them to borrow from an informal moneylender (with a higher interest rate.

Many farmers borrow from informal moneylenders. However, moneylenders will not borrow money to farmers from the lowest caste. When there is no NGO available in a village, the farmers have to arrange loans on their own. In that case, they go more often to a local moneylender because it is too difficult for them to borrow from a formal bank (they do not have enough land or jewelry to get a loan). Local moneylenders in Tamil Nadu charge a very high interest rate. They ask five percent interest per month, which is (1.05^{12}) 79.8 % per year. As a result, farmers need to work hard to pay back the interest. Besides that, they need to find a way to pay back the loan. This results sometimes in huge debts. Overall, the reasons for not taking any loan in general are diverse. Very poor farmers, older farmers or single adult households often do not want to take any loan because they would never be able to repay. At the same time, richer farmers do not always need to borrow necessarily.

Saved money
An increase in land size with five acres increases the probability of using savings in order to cope with 16 percentage points. Perhaps, farmers with a bigger land size have more agricultural income and have advantages of returns to scale. This could result in more savings possibilities. They can use these savings during or after natural disasters in order to buy some extra food or have some extra money for other purposes.

The biggest part of the poor farmers has only a small amount of savings. The farmers, who have savings, state to use these during natural disasters in order to cope. Farmers, who do not depend on agriculture for their income or earn a lot, do not need to use their savings during natural disasters because they earn money though other jobs. Therefore, the rich farmers and the really poor farmers do not use savings during natural disasters.

Reduce consumption
An increase in the age of farmers with twenty years increases the probability of reducing consumption to cope with 16 percentage points. As was expected, older people are less able to pay back a loan and therefore borrow less. They face difficulties by gaining income through non-farm jobs as well. In addition, they have fewer assets. Their coping options therefore come down to reducing the costs of consumption. The influence of age on the use of coping strategies is big. Older farmers face many problems when dealing with natural disasters. This is why they have to fall back on cutting back their consumption. An increase in education level with one decreases the probability of reduction in consumption to cope with 7 percentage points. This implies that high educated farmers (graduate level and above) have 30 percentage points less probability to cut back their consumption during natural disasters than illiterate farmers. Higher educated farmers have a lower probability of reducing their consumption, because they probably have a higher income[7]. Therefore, reducing their consumption is less necessary. An increase in crops with five leads to a reduced probability of 21 percentage points in cutting back the consumption costs. Those farmers can probably live better of the various crops and have some food left from their land during disasters.

In Tamil Nadu the staple food is rice. Throughout the state the farmers eat a lot of rice. Many farmers in the villages have access to government rice for 1 or 2 rupees per kilogram. This is a reason to not reduce consumption during natural disasters. They can buy the cheap rice to be able to eat three meals a day. Some farmers (older or very poor farmers) state to already take so little, that they cannot reduce consumption further. When farmers depend mainly on off-farm jobs for their income, it is not necessary for them to reduce their consumption after crop losses. If farmers have enough

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[7] Correlation between Income and Education is 0.2 and the P-Value is 0.01.

land, they often have enough food for their own consumption during the drought. Especially farmers who cultivate rice, can eat their own rice during bad times. However, many farmers reduce their consumption in one way or the other. The ways of reducing consumption varies from taking two instead of three meals a day, only eating rice with water and salt (for really poor), eating less or no meat, eating fewer vegetables, eating cheaper food, buying fewer saris and reducing the costs of festivals (for richer farmers).

Take children out of school
An increase in the household size with one increases the probability to take children out of school with 3 percentage points. More members can result in higher costs and hence children are taken out of school to save costs. Or more members could imply more children whereby some children can go to school and the rest can help at the farm.

Most of the times, the secondary school is for free in Tamil Nadu. Poor farmers even mention that they send their children to school because of the free food that is given there. Almost everyone states that school is very important. Hence, they never want to take their children out of school. Cases of children working instead of going to school are related to alcoholism, death of a parent or a huge amount of debts. When children have to be taken out of school, the girls always have to quit school instead of the boys. This is related to the Indian culture whereby the position of the women is not equal to the men yet. Women have to prepare the food and do the house keeping next to their jobs and men only have to work. In general, many children in the rural areas quit after the 10th or the 12th standard (secondary school) in order to work.

Reduce the costs of agriculture
There is no factor that influences specifically the decision to reduce the costs of agriculture. This could be related to the fact that this strategy is applied very often by the farmers in Tamil Nadu. Moreover, the various risks have been analyzed together. While drought can result in an increase in agricultural costs through extra wage labor while flood vanishes all the crops and the land is left alone (so the costs of agriculture are reduced). This can have mixed up the results and therefore the coefficients turned out to be insignificant.

Farmers reduce their agricultural costs by plowing themselves instead of hiring draft animals, applying no pesticides or fertilizers, engaging their own family in agriculture instead of hiring wage laborers and cultivating a smaller part of the land. Some farmers can reduce agricultural costs during drought by one of these examples. If farmers already have very low agricultural costs, they cannot reduce these costs further in any way. Other farmers cannot reduce their costs, because they do not have wage laborers in the first place or they need for instance the laborers for extra weeding due to a drought. Furthermore, some do not reduce the amount of fertilizer because the loss would be even bigger when less fertilizer is applied. Others reduce the fertilizer or even leave the land fallow because of the drought. Otherwise, the costs of cultivation outweigh the meager income from the bad crop yield. When farmers have pest and diseases in their crops, they need to apply more pesticides and fertilizers. Consequently, the agricultural costs are increased.

Daily migration
Farmers, who earn less than 25000 rupees per year, have 16 percentage points more probability to migrate daily to earn extra money. The poorest farmers have to do as much as possible in order to gain extra money. This implies that one or more members travel every day to gain extra income. An increase in the age with twenty years decreases the probability to migrate daily with 10 percentage points. The health condition of older people is worse and their working capacity is less. Travelling is also difficult for older people, because it takes a lot of energy and time. This makes it more difficult for them to migrate daily in order to gain additional income.

During or just after a natural disaster, it is difficult to find a job in agriculture. Hence, some farmers move to the city to find work. Farmers, who possess a lot of land have to work a lot on their own farmland and do not have time to work off-farm. A part of the farmers cannot get an off-farm job for various reasons. Some state that they do not have proper education to find a job out of agriculture. Others are too old or their health condition is too bad to work off-farm. Covariant shocks often make wage labor in other farmers' land impossible. Moreover, a part of the farmers do not want to work for other people. These are maybe high caste farmers, who cannot do these kinds of jobs because of their caste. However, this remains a hypothesis. Many farmers want to stay in agriculture for the sake of doing it; it is their tradition. Some farmers do not want to migrate to the city because of the high expenses and living standard there. Others want to continue farming because of tradition or because their main livelihood is agriculture.

Long term migration
Farmers, who earn less than 25000 rupees per year, have 13 percentage points less probability to migrate for a longer period to gain additional income. The jobs in big cities far away or abroad are only appropriate for the highly educated people. The poorest farmers are often not well educated and they are not able to work for a job in the city or abroad. Migrating to the city or further away is also too expensive for these poor farmers. The transportation costs are high and the daily expenses in other cities and countries are higher than in their villages. Therefore, they are unable to get themselves out of the poverty. An increase in age with twenty years decreases the probability to migrate for a long term with 10 percentage points. The health condition of older farmers is worse and their working capacity is less. This makes it more difficult for them to migrate for a long term in order to gain additional income. Moreover, older farmers are often less educated and therefore cannot get a better high-skilled job. An increase in land size with five acres decreases the probability to migrate for a long period with 10 percentage points. This is related to the fact that farmers with a big amount of land have a lot of work on the farm and have no time and fewer possibilities to leave their land for a longer period. Farmers, who live in Nilgiris have (compared to farmers who do not live in Nilgiris) 29 percentage points less probability to migrate for a long period. The hill area results in fewer possibilities to migrate because of the difficult location.

The reasons behind the decisions for long term migration are the same as for daily migration. The difference for migration for a longer period is often that some start-up money is needed in order to send a member away. Money is needed to send them abroad or to a city far away to look for a job. Therefore, poorer and older farmers have more difficulties to use this strategy. Farmers often go to an informal moneylender to be able to send a member away to work. This is also a result of the reluctance of formal banks to provide a loan for sending a member away. In addition, family and friends often cannot provide these huge amounts of money needed.

Sell luxury goods
An increase in age with twenty years increases the probability to sell luxury goods with 14 percentage points. I expected that older farmers own fewer luxury goods to sell during a disaster. On the other hand, they might own fewer luxury items but need to sell the few luxury goods they own, because they do not have many other coping options. An increase in the education level with one increases the probability to sell luxury goods to cope with 7 percentage points. Farmers with a higher income have more assets and can more easily sell some luxury goods to gain extra income.

The amount of luxury goods, which farmers possess, is often related to their income. Especially big farmers or farmers, who mainly depend on non-farm jobs for their income, have a lot of luxury goods. There is not a lot of jewelry in households where (many) daughters have been married before. These households have given their jewelry as dowry to the husbands' family. Luxury goods are not sold too often. Many farmers in India value status and prestige highly and they perceive these assets as status symbols. Other farmers have daughters who need the jewelry as dowry to get married in

the future. Farmers with a big land size have mentioned that they have enough food on their land to live. Therefore, it is not necessary for them to sell luxury goods. In general, not many farmers sell luxury goods during droughts.

Give collateral as a loan
Farmers, who own 100 grams more jewelry, have an increased probability of 20 percentage points to give collateral for a loan as a coping strategy. Although this is statistically significant, it is doubtful whether this result has economical significance. On average, the interviewed farmers in Tamil Nadu own 42 grams of jewelry. An increase in jewelry by hundred grams does not relate to the economic reality of the farmers in Tamil Nadu. Farmers, who cultivate mainly paddy, have 14 percentage points more probability to use collateral for a loan as a coping strategy. It is difficult to reason why this is the case. Paddy is a crop, which is more vulnerable to drought and therefore paddy cultivators might need more loans. An increase in the household size with one increases the probability to give collateral to get a loan with 5 percentage points. Perhaps more members in a household also results in more need for a loan to gain extra money. As a consequence, collateral is given as a loan. Whether this is truly the case, remains uncertain.

Many farmers give jewelry as collateral to the bank to get a loan. They call it a 'jewelry loan'. In that case they possess the jewelry. When they pay off the loan they get the jewelry back to marry for instance a daughter. When farmers possess jewelry, they often give it as collateral.

Get help from government
The probability to get help from the government decreases with 22 percentage points for the really poor. This shows that the government in Tamil Nadu does not reach the bottom of the pyramid. The probability to get help from government increases with 10 percentage points with twenty extra years in age. Perhaps, the government focuses the programs more on older farmers or mainly on heads of households (who are mostly older). Ten extra animals as livestock increase the probability to get help from the government with 9 percentage points. This is related to the livestock insurance programs. An increase in the amount of crops with five decreases the probability to get government help with 23 percentage points. This is probably related to the fact that the government help is often given through agricultural insurance. This crop insurance is mainly given to farmers who cultivate paddy or other crops as maize and groundnuts. These crops are often grown on their own or with only a few other crops, because of the difficulties with cultivation and harvesting. Farmers, who mainly cultivate paddy, have an increased probability of 47 percentage points to get help from the government. This is due to the paddy crop insurance programs of the government in Tamil Nadu.

The government in Tamil Nadu provides cheap rice and free televisions and bicycles. However, these kinds of help are provided to many farmers in Tamil Nadu. Sometimes farmers even possess a government television without electricity. Hence, it is not possible to find an effect of these kinds of help. Only government help by providing insurance or post-disaster money is relevant for this research. One kilogram of rice for one rupee might influence the coping strategies of farmers, because they can always get a sufficient amount of rice after a bad harvest. For instance a huge drought could have less effect on the farmers in Tamil Nadu than farmers in an area without government help.

Wage labor in agriculture
An increase in the age of farmers with twenty years decreases the probability to work as wage laborer in agriculture as a coping strategy with 22 percentage points. This is again related to the fact that older farmers have fewer possibilities to get a job. They are less wanted because they are slower and their health is not as good anymore. If they get a job, their wage is very low. Moreover, an increased education level decreases the probability to work as wage laborer in agriculture to cope with 10 percentage points. Highly educated farmers have better access to non-farm activities outside

of agriculture to obtain additional income. An increase in the amount of cultivated crops with five increases the probability of using wage labor in agriculture as a coping strategy with 30 percentage points. Farmers, who diversify their crops have more land and probably depend more on agriculture for their income[8] and are less able to work for jobs outside of agriculture. Therefore, they work as wage laborer in agriculture as a coping strategy.

Many farmers try to find an off-farm job after natural disasters happen. They need extra income to compensate for the big losses. A reason for farmers not to have an off-farm job is the inability to get a job. During a drought everyone wants an extra job in the village. There is not enough work because everyone is affected by drought (especially in rain fed areas). This is sometimes a reason for farmers to move eventually to the city. Besides that, older farmers cannot get a job easily because their health condition is too bad to be able to work somewhere else. Even if they find other work, they are paid a very low wage. In addition, the elderly are sometimes left on their own by their children. When for instance a drought occurs, they cannot cope. The only thing they can do is reduce their consumption and other costs.

Rent out land
An increase in the age of farmers with twenty years decreases the probability to rent out land to cope with 6 percentage points. Older farmers often have only a small part of land left. They cultivate this small part and this is their main income source. They cannot easily to rent out this land, because that would imply that they lose their main income source. Farmers, who mainly cultivate paddy, have 10 percentage points more probability to rent out their land. Those farmers are more vulnerable to droughts. Perhaps those farmers rent out their land because they have more difficulties to gain income from their land.

The biggest part of the farmers does not want to rent out the land. First of all, the farmers who cultivate rented-in land cannot rent out their land. In some districts there is no demand for renting in land since it are drought-prone areas. Consequently, farmers cannot rent out land. Other farmers do not want to rent out their land because they do not trust other people to take good care of their land. The small farmers do not have enough land to rent an extra part of their land out to somebody else. Only a few farmers rent out their land during a drought or flood, mostly a small part of their land.

Borrow from a formal bank
Farmers, who mainly cultivate paddy, have an increased chance of 13 percentage points to borrow from the formal bank. Paddy is an irrigated crop and more vulnerable to droughts. Perhaps those farmers need to borrow more money to be able to irrigate the land sufficiently. An increase in the amount of crops cultivated with five increases the probability to borrow from a formal bank with 16 percentage points. It is possible that farmers who cultivate more crops have more land and can, therefore, more easily get a loan from a formal bank.[9]

Only a small amount of farmers borrow from a formal bank. NGOs sometimes help the farmers to arrange a group loan at a bank. In order to get a formal loan, a lot of documents have to be filled in. For many farmers, this is too difficult because they do not understand the formalities. Especially older farmers cannot read or write, so they do not know how to apply for a loan at the bank. Moreover, obtaining a formal loan is time consuming, while they need money for their immediate needs. In some areas, farmers cannot get loans because, they do not vote for the ruling party. So the corruption in India increases the difficulties of obtaining formal credit.

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[8] Pair wise correlation between crops and land = 0.28 and the P-value =0.000.
 Pair wise correlation between crops and ratio agricultural on total income = 0.21 and the P-value =0.008.
[9] The pair wise correlation of crops and land is 0.27 and the P-value is 0.0003.

Sell livestock

The really poor have a decreased probability of 17 percentage points to sell livestock. They probably cannot buy livestock and, therefore, they do not have a lot of livestock. During crises, they cannot sell these animals in order to obtain extra money. Farmers with higher income have more assets and can more easily sell livestock to gain some extra income. An increase in education level with one increases the probability to sell livestock with 8 percentage points. Higher educated farmers have a higher income and can buy more animals. An increase with hundred grams of jewelry decreases the probability to sell livestock with 20 percentage points. Whether this is economically significant is questionable, because it does not relate to the economic reality of farmers in Tamil Nadu. An increase in the amount of livestock with ten raises the probability to sell livestock as a coping strategy with 30 percentage points. Farmers, who live in Nilgiris have (compared to farmers who do not live in Nilgiris) 39 percentage points less probability to sell livestock. As stated before, it is more difficult to keep livestock in this hill area and thus less selling of livestock to cope is less common.

Some farmers sell livestock during a drought to gain extra money. It is better for them to sell livestock and obtain extra money, because their livestock can also get affected by for instance droughts and the animals can get diseases. Other farmers do not sell livestock, because the maintenance of their animals does not take too much effort. During a drought, the dry useless crops can for instance be used as fodder for their livestock. Other farmers get a steady income out of livestock and cannot afford to sell their animals. A part of the farmers sells the milk of their cows every day. Others bring their livestock to another farmers' field to graze and give manure to that field. In exchange for doing this, they receive money.

Agricultural insurance

The poorest part of the farmers has 23 percentage points less probability to have agricultural insurance. Firstly, farmers have to own one acre of land to be eligible for agricultural insurance. The poorest farmers do not own that amount of land. Secondly, those farmers probably have more difficulties to pay a monthly premium in order to insure themselves. This makes it difficult for crop insurance programs to target the poorest part of the farmers and therefore these farmers get more easily excluded. An increase in jewelry by hundred grams increases the probability to have agricultural insurance as a coping strategy with 10 percentage points. The same holds here; whether it is economically significant is questionable as well. An increase in livestock with ten increases the probability to have agricultural insurance with 18 percentage points. This is due to the fact that agricultural insurance includes crop insurance as well as livestock insurance. Some farmers have livestock insurance through DHAN. Farmers, who mainly cultivate paddy, have an increased probability of 33 percentage points to have agricultural insurance. This is due to the crop insurance programs for paddy in Tamil Nadu. An increase in household members with one decreases the probability to have agricultural insurance as a coping strategy with five percentage points. It is difficult to reason why bigger households would more often have agricultural insurance.

There is no widespread coverage of agricultural microinsurance for farmers in Tamil Nadu. Only a few villages have access to microinsurance where the government in Tamil Nadu provides agricultural insurance for farmers who cultivate rice. Besides that, in a few other villages DHAN Foundation has set up crop insurance and livestock insurance schemes. In these villages, a part of the members of DHAN Foundation have crop or livestock insurance.

The analysis is not only based on the LP model, but also on the Probit model. Therefore, the marginal effects of the Probit model are shown in Table 15 in the appendix. The table is given, in order to verify the coefficients of the Linear probability model and confirm the robustness of the model.

5.2.5. The LPM and Probit model compared to the MV Probit model

The results of the Multivariate Probit are relatively similar to the results of the linear probability model and the Probit model. However, for the MV Probit categories I have used categories and the correlations between the strategies have been taken into account. Therefore, there are also differences between the outcomes of the two models. In this section, I will compare the categories with the separate coping strategies.

Category 1

An increase in the independent variables education and jewelry decreases the probability of using the coping strategies from category one. The LPM shows that education has indeed a negative effect on reducing the costs of consumption and working as a wage laborer in agriculture. Jewelry, however, does not seem to have a significant effect on the separate coping strategies. The MV Probit provides information that would not have been available if I would have only used the LPM and Probit model. On the other hand, the LPM has shown that other factors, besides jewelry and education, influence the separate coping strategies. Especially the independent variable 'age' influences the coping strategies a lot. The influence is positive for reducing consumption and negative for daily migration and wage labor in agriculture. That is probably why this variable did not turn out significant in the MV Probit analysis.

Category 2

An increase in age decreases the probability of using strategies from category two. The LPM confirms this for borrowing from friends and family and migrating for a longer period. An increase in education increases the probability to use of category two, which is confirmed by the LPM as well; an increase in education increases the probability to borrow from friends and family. Farmers, who live in Nilgiris, have less chance to use category two and have less chance to borrow from friends and family or migrate for a longer period as well. The significant influence of livestock and crops in the MVProbit, cannot be seen back in the separate Linear probability models. Perhaps, also here, the MV Probit gives information that would have not been known, if I would have only used the LPM and Probit model. An increase in land decreases the probability to migrate for a longer period and increases the probability to use savings to cope. This is probably not seen back in the MV Probit, because the variable has opposite effects on the two strategies.

Category 3

An increase in education increases the probability to use category three in the MV Probit, as well as the probability to sell luxury goods in the LPM. In addition, an increase in jewelry increases the chance for applying category three in order to cope. It also increases the probability to give collateral as a loan. An increase in paddy increases the probability to use category three, as well as the probability to give collateral for a loan and borrow from the bank in order to cope. Besides that, an increase in members increases both the probability to use category three and give collateral for a loan. The MV Probit does not give an effect of age or crops on category three, while an increase in age increases the chance to sell luxury goods and an increase in crops increases the probability to borrow from the bank. This shows that the separate analyses provide additional information.

Category 4

No independent variable has an effect on the use of category four, as well as on reducing the costs of agriculture. However, an increase in paddy increases the probability to rent out land as a coping strategy. At the same time, an increase in age decreases the chance to rent out land. Perhaps this is not seen back in the Multivariate Probit, because the insignificant results of reducing agricultural costs had more impact than the significant results of renting out land. (Reducing the agricultural costs has been applied by 110 farmers and renting out land has been used by merely 12 farmers).

Category 5

An increase in jewelry decreases the chance to use category five to cope. The MV Probit provides complementary information, because this result is not seen back in the separate linear probability models. An increase in livestock increases the probability to use category five, as well as the probability to sell livestock and borrow from an informal moneylender. The LP model and Probit model provide extra information, which the MV Probit does not show. An increase in the household size increases the chance to take a child out of school to cope. The really poor farmers have a decreased probability to sell livestock or borrow from an informal moneylender. I expected beforehand, that the poor farmers would apply more stressful coping strategies. However, it appears that they do not have access to these stressful mechanisms, because they have fewer possibilities to own livestock or to get a loan from an informal moneylender. Furthermore, an increase in education increases the probability to sell livestock. Farmers from Nilgiris have a decreased probability to sell livestock. Finally, an increase in land decreases the probability to borrow from an informal moneylender.

Overall, it has been a good choice to use the linear probability model as well as the Multivariate Probit model because the information from both models can complement each other and provide additional information that would have not been clear if I would not have used the models together.

5.2.6. The Poisson regression

In order to know whether the independent variables influenced the amount of applied coping strategies, I have used a Poisson regression. The output of this analysis is shown in Table 14.

Table 14: Poisson Regression the amount of coping strategies

N=164	Amount of used Coping Strategies
	Poisson
Income poor	-0.116
	(0.105)
Age	-0.005
	(0.003)
Education	0.009
	(0.034)
Jewelry	-0.000
	(0.001)
Livestock	0.006
	(0.005)
Land	-0.004
	(0.015)
Crops	0.007
	(0.025)
Paddy	0.142
	(0.077)*
Members	0.027
	(0.018)
Nilgiris	-0.431
	(0.187)**
Constant	1.658
	(0.206)***

Standard errors in parentheses
* Significant at 10%, ** significant at 5%; *** significant at 1%

The Poission regression shows that the independent variables do not have much effect on the amount of used coping strategies. However, farmers who cultivate paddy as a main crop, use 0.14 more coping strategies than farmers who do not mainly cultivate paddy. Although this result is statistically significant, it does not hold much economical significance. 0.14 extra coping strategies is not much and will help farmers a lot in dealing with disasters. Moreover, farmers who live in Nilgiris, use 0.43 less coping strategies than farmers who do not live in Nilgiris. This could be related to their higher income on average. Since they have a higher annual income compared to farmers in other regions, the consequences of natural disasters might be less severe for them. They are in less need to find various ways to generate additional income (for instance through wage labor or migration).

6 Conclusion and discussions

In this thesis I have explored which factors influence Tamil Nadu's farmers' decisions for coping strategies and how these factors influence their decisions. Farmers in Tamil Nadu mainly encounter droughts, floods and pest and diseases in crops, which happen almost every year. Therefore, they are very concerned about these agricultural shocks. The natural disasters occur at least at the village or region level, so they are covariant. The coping strategies, that farmers use in order to deal with these disasters, can have positive or negative effects for the household in the long run. Borrowing from a moneylender, taking the children out of school and reducing agricultural costs have negative consequences in the long run. When farmers rent out land, sell luxury goods, give collateral or sell livestock they deplete their valuable and productive assets. Less stressful coping strategies are reducing the consumption, borrowing from friends and family or a formal bank or using saved money. Gaining additional income through wage employment in agriculture, daily migration and long term migration are better options, because they result in income diversification and an increase in income without depleting assets. In addition, agricultural insurance can make farmers more independent and resilient against disasters.

The hypotheses on influential factors for farmers' coping decisions have been confirmed by this research. The findings have shown that the amount of natural, physical, human, financial or social capital which farmers possess influences their coping decisions. First, this study proves that poor farmers have fewer coping options. They have less access to agricultural insurance and government help and they have fewer possibilities to sell livestock, migrate for a long period or borrow from an informal moneylender. Second, the older farmers more often reduce their consumption, because they have less access to gain additional income through other jobs, borrowing money or renting out land. They mainly reduce their consumption or sell the luxury goods, which they have left. Third, lower educated farmers have fewer assets and it is more difficult for them to sell luxury goods, borrow from friends and sell livestock. Therefore, they are forced to reduce their consumption or work as a wage laborer in agriculture. Moreover, they do not have the educational skills to work outside of agriculture. Fourth, farmers, who own more assets such as jewelry, livestock and land, have more coping options. They can give collateral in order to get a loan and sell their livestock. Possessing more land reduces the need to borrow from a moneylender, but owning more livestock increases this need. Farmers who have a bigger land size do not have enough time to migrate for a longer period in order to cope. Fifth, the amount of crops influences the coping decisions as well, because farmers who cultivate more crops are more able to keep their consumption on a normal level during natural disasters. For that reason, it is less necessary for them to reduce the costs of consumption. They work more often in agriculture as wage laborer and they own more land, which results in better access to formal credit. Sixth, cultivating mainly paddy increases the access to assistance from NGOs and the local government and hence access to formal credit. In addition, due to the drought-proneness of paddy, paddy cultivators have an increased probability to rent out their land in order to cope. Seventh, bigger households are more vulnerable than expected. They take children more easily out of school, give more often collateral as a loan to cope and are less likely to have agricultural insurance. Finally, farmers who live in the hilly area and the less drought-prone region Nilgiris do not have to use many coping strategies such as selling livestock, migrating for a long term or borrowing from friends, because they are less affected by natural disasters.

This research has increased the knowledge on the reasons behind the farmers' coping decisions, which can be useful for NGOs, microfinance providers and policymakers in Tamil Nadu. By becoming aware of the differences between farmers, tailor made solutions could be provided. They can base their policies and assistance on the livelihood capital of the farmers. Older, poor or low caste farmers, who have no assets and have few possibilities to gain additional money, are a different target group than rich farmers, who have sufficient income and assets. In the provision of, for instance, agricultural insurance and borrowing possibilities by NGOs and the government, this distinction is not always made. This research can give NGOs and the government in Tamil Nadu more insights in how the farmers in Tamil Nadu can be assisted in dealing with natural disasters.

In general, the results of this study are important for Tamil Nadu and could perhaps be generalized to the whole country. For India not only economic strategies play a role, but also the social strategies are very important, because cultural and social status is very important. As a result, these economic and social strategies are very interrelated in India. To understand this research, the caste system and the importance of status in Tamil Nadu need to be understood as well. The Indian social system has an impact on the economic coping decisions which farmers make. An Indian farmer from a lower caste is limited in finding another job as well as in borrowing from friends. In addition, the economic situation can affect the social strategies. Farmers, who earn a lot of money, will not easily borrow money from friends or ask for help. Their 'high status' is too important to lower themselves to ask others for help. Probably, these conclusions can be drawn for India in general, because the caste system is still a very important aspect in this country. In other countries, where hierarchy plays a big role, these influences could be the same. When taking into account other contexts, the results could be used outside of India. In general, the social, human, physical, financial and natural capital of farmer households, need to be taking into account when analyzing the use of coping strategies. However, in another country, a different hierarchal system or other social conditions can have other effects on the decisions to apply coping strategies.

Although the research provides interesting results, there are several limitations as well. First, my sample size consists of only 164 farmers. Second, the farmers in Tamil Nadu spoke their own language 'Tamil' and could not speak English. I needed translators to translate from English to their 'Tamil' language and back. Probably, some information got lost during this translation process, because the results of the research depended on the accuracy and objectivity of the translators. The translating of the questionnaires 'on the spot' during the interviews has probably resulted in a bigger loss in information than if the questionnaires would have been translated to Tamil beforehand. In that case, I could have checked whether the translation was correct and the chances of mistakes due to translation would have been reduced. However, the field research started the day after I arrived, so I did not have the time to translate the questionnaires. Third, there were different translators in the various areas. The advantage was that the translators were familiar with the context, background and language of the farmers, which made it easier for them to communicate with the farmers. On the other hand, the use of different translators made the research less consistent. Fourth, the research relied also on the truthfulness and accuracy of the answers given by the farmers, which is a common problem for research. Fifth, I faced difficulties during the focus groups, because farmers mostly gave the same answers and their individual opinions remained unclear. There was not enough time to have sufficient in-depth interviews, which made it difficult to do a full qualitative analysis. Sixth, in hindsight, I have realized that I should have asked some questions differently in order to gain more information for my analyses. An example is the question related to the education level of the respondents. Unfortunately, this cannot be changed anymore. Finally, the models and estimation methods which t I used to analyze had their own advantages and disadvantages. The Multivariate Probit model took into account the correlation between the coping strategies, but information got lost due to the categorization of these strategies. I have analyzed the separate coping strategies through the Linear probability model and the Probit model, but the correlations between the coping strategies were not taken into account.

The validity of this research is also limited by my sampling strategy. I applied quota sampling instead of random sampling, which reduces the possibility of generalizing the results on influential factors for coping strategies. Not every farmer in the population (of farmers in Tamil Nadu) had an equal chance of being selected. The disadvantage of this strategy is that specific types of farmers might have been excluded in the study. As a result, it is not sure whether an increase in the sample size increases the possibility that the statistics from the sample would move toward true values of the population. It is possible that these research results are relevant for Tamil Nadu or even India in general. This, however, remains uncertain due to the sampling strategy and the case specific factors that might have had an influence. The research has been carried out in the specific context of Tamil Nadu. Therefore, the outcome of the research could be only relevant for NGOs, microinsurance providers and other organizations in Tamil Nadu. To ensure whether the results could be generalized, I would recommend further research. It would be valuable to research this topic in another state in India or in another country in order to know whether or not they would generate the same results. It then might become clear whether the research results have a true scope for generalization. In this way, the understanding of important influences on coping decisions could be deepened.

7 Recommendations

The influence of the various factors on the choice or limitations of coping strategies of farmers in Tamil Nadu has its implications for policymakers, NGOs and microfinance providers in this state. Attention should be paid to these characteristics of farmers, when for instance insurance products are provided. Within the target group of farmers in Tamil Nadu, there are different types of clients. It might be useful to provide complementary services in order to improve the livelihoods of the farmers. An example could be increasing the education possibilities for the uneducated farmers (or children) in order to enhance their non-agricultural job possibilities. Moreover, improved education could also result in better management decisions on the farm. Farmers might sell less productive assets, grow more crops and invest in higher risk higher return seeds once they know how important this is. Moreover, micro pensions would be an essential complementary product. As seen, the elderly farmers in Tamil Nadu have almost no possibilities to cope with natural disasters. They still have to work at the farm at an old age and are very vulnerable. It is very difficult for them to lead a pleasant and sustainable live at old age. Fasting and reducing consumption are often the only possibilities they have. It is necessary to make farmers understand to pay a premium every month when they are young in order to save for a pension in the future.

Climate change makes it also essential to focus on income diversification because farmers who completely depend on agriculture have more difficulties to cope. This might also be necessary to keep the tradition of farming alive, since fully depending on agriculture has become an almost unrealistic goal in the drought-prone state of Tamil Nadu. (Hopefully, this can chance in the future through among others, the tank fed and rain fed programs of DHAN Foundation.) Next to that, crop diversification should be stimulated and irrigation possibilities through tanks, canals or bore wells are vital for the crop (such as paddy) cultivation in Tamil Nadu. So far, paddy cultivators have revealed to be very vulnerable. However, NGOs mainly focus on paddy cultivators while farmers, who cultivate other crops, also face difficulties. Hence, NGOs should increase their programs and also integrate various programs in order to provide all the services needed to give fully support to the farmers. Thereby, they should bear in mind to include also the poorest part of the farmers (perhaps the lowest scheduled caste.) A bigger land size has its advantages and therefore collaboration between various farmers might prove to be very effective. Bigger households could have more difficulties to cope, so micro finance providers should consider the amount of members in a household that depend on the insurance pay-outs. Finally, paying attention to the local context and needs of the various farmers can provide important insights into the necessary complementary interventions. This research provides valuable information that can be used to further brainstorm on the essential adjustment that need to be made in the future.

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9 Appendices

Appendix 1: the questionnaire
1. Household Identification

Date of interview: _____   Interviewer: _____
Household number:_____
Circle: irrigated, rain fed, tank fed, other(& specify)
Circle remoteness of the village: not remote, little remote, remote, very remote
NGO member: yes/no

1. Name _____

2. Please indicate your age: _____

3.   Gender
☐ Male
☐ Female

4. What is your education level? :
☐ Not literate
☐ Primary
☐ Middle
☐ Secondary/ senior secondary
☐ Graduate/ and above

5.   Address information:

State/u.t.: Tamil Nadu	Address:
District:	**Name of head of household:**
Village name:	**Relation to head of household:**

6. What are the reasons for you to live in this area in Tamil Nadu?
☐ I came to live here for work   ☐ I came here because of marriage
☐ Own property   ☐ It is my native place
☐ Ancestral property   ☐ Access to education
☐ Cheap   ☐ Other (Specify) _____

7. How many members does your household have? :
Number of adults:_____
Number of children: _____
Number of household members working: _____
Number of household members consuming/ going to school: _____

8. Do you own land?
☐ Yes
☐ No, skip to question 8.3

8.1 How big is your land?
_____ Acre

8.2 Next to the cultivated plots, do you also have fallow land? (Fallow land is land that is not cultivated at the moment.)

☐ No
☐ Yes, how big is your fallow land?

_____ Acre

8.3 Do you rent- in land?
☐ No
☐ Yes, _____ Acre

9. What was your income in 2008 and in 2009?

In 2008, my income was around_____Rs.

In 2009, my income was around_____Rs.

10. Which of these properties do you own? (Put an "X" if you own this property.) If you know how much it is worth, please fill in the value in Rupees.

Property	I own this
Land	
Livestock, how many and what kind of livestock do you have?	
House	
Motorcycle	
Car/truck	
Tricycle	
Bicycle	
Tv	
Refrigerator	
Jewelry, how many grams?	
Others	

11. Where do you get your income from?
Fill in which job provides your income. Also fill in whether you get a large part of your income from this work, or whether you get a small part of your income from that job.

Work	Large part of income	Small part of income
Agriculture		
Livestock		
Fishery		
Business		
Wage labor in agriculture		
Wage labor non-agriculture		
-Government schemes (construction work)		
Services		
Family members sending money back home		
Others……………………		

11.1 Do you have contact with first line family outside of your household?

☐ No
☐ Yes

If yes, do they send you money back home?

☐ No
☐ Yes, how much per year? _____ Rs.

11.2 If you participate in non-farm activities, what jobs do you do? Please, fill in which job, how many days a year you do this job. Also fill in much you earn per day of labor or per KG of output.

Type of activity	Family member	Labor days/ year	Earnings per labor day or per KG.	Use for own consumption or agriculture

11.3 If you do not have off-farm work. What are the reasons for this?

☐ No time
☐ Not necessary
☐ Not possible to find a job
☐ No access to another job (incl. age, health)
☐ Other, _____

12. What kind of crops do you produce? Fill in what your crop of main production is and your crop that you produce it in a smaller amount. Mark the correct answer with an "X". If it is irrigated/rain fed, then you can thick that box too.

Kind of crop	Main Crop	Not main crop	Rain fed	Irrigated
Cotton				
Paddy				
Maize				
Millet				
Moong				
Gram				
Varagu				
Sorghum				
Other……….				

13. Do you have a loan?

☐ Yes
☐ No (If "NO", skip to question 14.)

13.1 If yes, how big is your loan?

_____ Rs from an informal money lender.

_____ Rs from an official institution (microfinance, NGO, etc.)

_____ Rs from a friend

13.2 If yes, where do you use the loan of the informal money lender for the most?

☐ Food   ☐ House construction   ☐ Health
☐ Education children   ☐ Livestock   ☐ Other_____
☐ Fertilizer, pesticides, crops ☐ Car, bicycle & motorcycle
☐ Unexpected expenses   ☐ Marriage children

13.3 If yes, where do you use the loan of the official institution for the most?

- [ ] Food
- [ ] School
- [ ] Fertilizer & pesticides, crops
- [ ] Unexpected expenses
- [ ] House construction
- [ ] Livestock
- [ ] Car, bicycle & motorcycle
- [ ] Marriage children
- [ ] Health
- [ ] Other_____

13.4 If yes, where do you use the loan of the official institution for the most?

- [ ] Food
- [ ] School
- [ ] Fertilizer & pesticides, crops
- [ ] Unexpected expenses
- [ ] House construction
- [ ] Livestock
- [ ] Car, bicycle & motorcycle
- [ ] Marriage children
- [ ] Health
- [ ] Other_____

14. Do you know what insurance is?
- [ ] Yes
- [ ] No (If you answered NO, you can skip to Questionnaire II)

15. Does your household have insurance coverage for agricultural or livestock losses due to the weather?
- [ ] Yes (If you answered YES, skip to Question 16.1)
- [ ] No

16. If "NO", what is the main reason your household does not have agricultural insurance?

- [ ] My own ways of dealing are enough
- [ ] Too expensive
- [ ] Not necessary
- [ ] Never considered it
- [ ] I do not trust it
- [ ] I do not know about it
- [ ] I do not have access to insurance
- [ ] Other _____

Questionnaire

	Could you order the disasters? 1 most important	How many times did it happen? You can find the numbers in Table 1	Which happened in 2009?	Which happened in 2007 or 2008?	How big was the area affected by the disasters? 1 household 2 village 3 region 4 Tamil Nadu	Which action did you take to deal with these disasters? (Choose options from Table 2)	Did it help? Fill in the correct number: 1 very much 2 regular 3 little 4 not at all	How much of your agricultural revenues did you lose? 1 very much 2 much 3 little 4 very little	How much of your loss did you gain back with your actions? 1 very much 2 much 3 little 4 very little
Natural disasters:									
1. Droughts									
2. Too much rainfall									
3. Floods									
4. Pest and diseases in crops									
5. Pest and diseases in livestock									
6. Wind									
7. Tsunami									
8. Other									

Table 1:
1 = more times per year
2= once a year
3= once every two year
4= once every three years
5= once every four years
6= once every five years
7=other

Table 2: actions to deal with the disaster:
1. Borrow from friends, relatives & family.
2. Get a loan from a moneylender.
3. Use saved money.
4. Reduce consumption costs.
5. Take children out of school.
6. Get money from family (sons etc.)
7. Reduce the agricultural costs.
8. Look for job in city (daily migration).
9. Member migrates (longer period) to earn money.
10. Sell luxury goods (jewelry, land).
11. Give collateral (jewelry) to get a loan.
12. Help from government/ public institution.
13. Off-farm work/ wage employment.
14. Rent out your land.
15. Pesticides.
16. Borrow from formal bank.
17. Sell Livestock.
18. Other options.

Appendix 2: Probit model
Table 15: Marginal Effects of the Probit Model on coping strategies

N=164	(1) Borrow friends N=93	(2) Money Lender N=58	(3) Saved money N=50	(4) Reduce consumption N=117	(5) Out school N=18	(6) Reduce Agr. Costs N=110
Income poor	0.018	-0.192	-0.084	-0.115	-0.045	0.097
	(0.120)	(0.093)**	(0.108)	(0.124)	(0.060)	(0.100)
Age	-0.009	-0.001	-0.004	0.009	0.001	-0.003
	(0.004)**	(0.004)	(0.003)	(0.003)***	(0.002)	(0.003)
Education	0.100	0.005	0.053	-0.074	-0.040	-0.041
	(0.042)**	(0.040)	(0.037)	(0.036)**	(0.025)	(0.037)
Jewelry	-0.001	-0.001	0.000	-0.001	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Livestock	-0.007	0.013	-0.002	-0.006	0.002	0.003
	(0.006)	(0.006)**	(0.006)	(0.005)	(0.003)	(0.006)
Land	-0.006	-0.047	0.035	-0.012	0.006	0.009
	(0.017)	(0.021)**	(0.016)**	(0.014)	(0.010)	(0.015)
Crops	0.025	-0.001	0.032	-0.047	-0.008	0.027
	(0.031)	(0.028)	(0.026)	(0.026)*	(0.019)	(0.028)
Paddy	0.097	0.063	-0.085	-0.039	-0.027	-0.030
	(0.091)	(0.090)	(0.082)	(0.084)	(0.052)	(0.085)
Members	0.023	0.023	-0.033	0.023	0.029	0.032
	(0.025)	(0.022)	(0.023)	(0.020)	(0.013)**	(0.023)
Nilgiris	-0.492	-0.074	0.043	0.010		0.099
	(0.110)***	(0.159)	(0.171)	(0.157)		(0.147)

N=164	(7) Daily migration N=27	(8) Long migration N=27	(9) Luxury goods N=24	(10) Collateral N=64	(11) Government help N=49
Income poor	0.212	-0.129	0.032	0.008	-0.212
	(0.119)*	(0.050)***	(0.079)	(0.120)	(0.076)***
Age	-0.006	-0.004	0.006	-0.001	0.005
	(0.003)**	(0.003)	(0.002)***	(0.004)	(0.004)
Education	-0.028	-0.024	0.058	0.034	0.017
	(0.030)	(0.027)	(0.026)**	(0.040)	(0.041)
Jewelry	-0.001	0.001	0.000	0.002	-0.000
	(0.001)	(0.001)	(0.000)	(0.001)**	(0.001)
Livestock	-0.002	-0.006	-0.000	0.000	0.009
	(0.004)	(0.005)	(0.004)	(0.006)	(0.005)*
Land	0.007	-0.033	0.010	-0.002	0.001
	(0.014)	(0.016)**	(0.010)	(0.017)	(0.017)
Crops	0.001	0.011	-0.031	-0.028	-0.049
	(0.021)	(0.020)	(0.021)	(0.030)	(0.028)*
Paddy	-0.085	-0.002	0.010	0.152	0.502
	(0.061)	(0.061)	(0.056)	(0.089)*	(0.080)***
Members	0.005	0.021	0.015	0.056	-0.036
	(0.017)	(0.015)	(0.014)	(0.023)**	(0.024)
Nilgiris			-0.035	-0.242	

N=164	(12) Wage labor agriculture N=99	(13 Rent out land N=12	(14) Formal Bank N=19	(15) Sell livestock N=68	(16) Agricultural Insurance N=53
Income poor	-0.004	-0.000	0.026	-0.088	-0.237
	(0.117)	(0.044)	(0.074)	(0.145)	(0.085)***
Age	-0.013	-0.002	0.000	-0.004	0.000
	(0.004)***	(0.001)*	(0.002)	(0.004)	(0.004)
Education	-0.113	0.023	-0.007	0.113	-0.058
	(0.042)***	(0.015)	(0.023)	(0.048)**	(0.041)
Jewelry	-0.001	0.000	0.000	-0.002	0.001
	(0.001)	(0.000)	(0.000)	(0.001)*	(0.001)
Livestock	0.004	0.001	-0.001	0.075	0.021
	(0.006)	(0.002)	(0.004)	(0.014)***	(0.007)***
Land	-0.023	0.002	0.003	-0.008	0.020
	(0.017)	(0.005)	(0.009)	(0.021)	(0.015)
Crops	0.069	0.005	0.026	-0.032	0.010
	(0.030)**	(0.010)	(0.015)*	(0.034)	(0.029)
Paddy	-0.036	0.098	0.128	-0.032	0.380
	(0.092)	(0.051)*	(0.062)**	(0.104)	(0.089)***
Members	0.016	0.000	-0.007	0.019	-0.058
	(0.024)	(0.008)	(0.014)	(0.029)	(0.026)**
Nilgiris	-0.221	0.050	0.082		
	(0.178)	(0.103)	(0.154)		

Standard errors in parentheses
* Significant at 10%, ** significant at 5%; *** significant at 1%