CHAPTER 3
# CONCEPTUAL FRAMEWORK

3.1 Risk Attitude and Determining Factors

The conceptual framework of risk attitude considers different socio-economic and political dimensions of the households and their effect on risk attitudes. It is graphically represented in figure 2. Agricultural organizations in rural areas are the main source of information and knowledge to rural households. Studies and researches conducted by the members of the agricultural ministries and non-governmental organizations provide firsthand information to the organizations. For example, studies on technology adoption, side effects of pesticides, occurrence of shocks and farmer's health as well as the economic benefits of micro irrigation are some of the many vital studies that provide useful knowledge to the agricultural organizations (Jack, 2013). The information comprises the risk and benefits associated with their consequences and the potential impact both positive and negative on the households. Similarly social organizations such as microcredit, village banks, social and political groups provide financial support and relevant information to improve household activities and awareness. These organizations are also influenced by the governance, policy and political culture of the society. In developing countries centralized governments usually control the political life of the nation (curbing public participation, undermining civil societies) and influence policy positions that promote social cohesion and transparency in a community. On the other hand agricultural organizations collect information on social capitals that would direct and assist policies and development programs to implement their objectives. Farmers may rely on credible scientific reports to understand the nature of agricultural inputs on their farm or the urgency of shocks (flooding, rainfall shortages) that may pose a big threat to their agricultural land. This creates the sense of trust on the farmers that eventually lead to attitude and behavior.

Since long times credible sources of information are recognized to build trust on individuals. For example an extension agent from an agricultural organization teaches about the pros and cons of new technology adoption. Eventually, the farmers develop

16

trust if they believe the information they are receiving is significant and important for positive impact. Through time, attitude and behavior are established that eventually lead to risk taking preferences. Hence in our graph trust acts as an important bridge between the sources of information and the risk attitude that evolves from the dynamics.
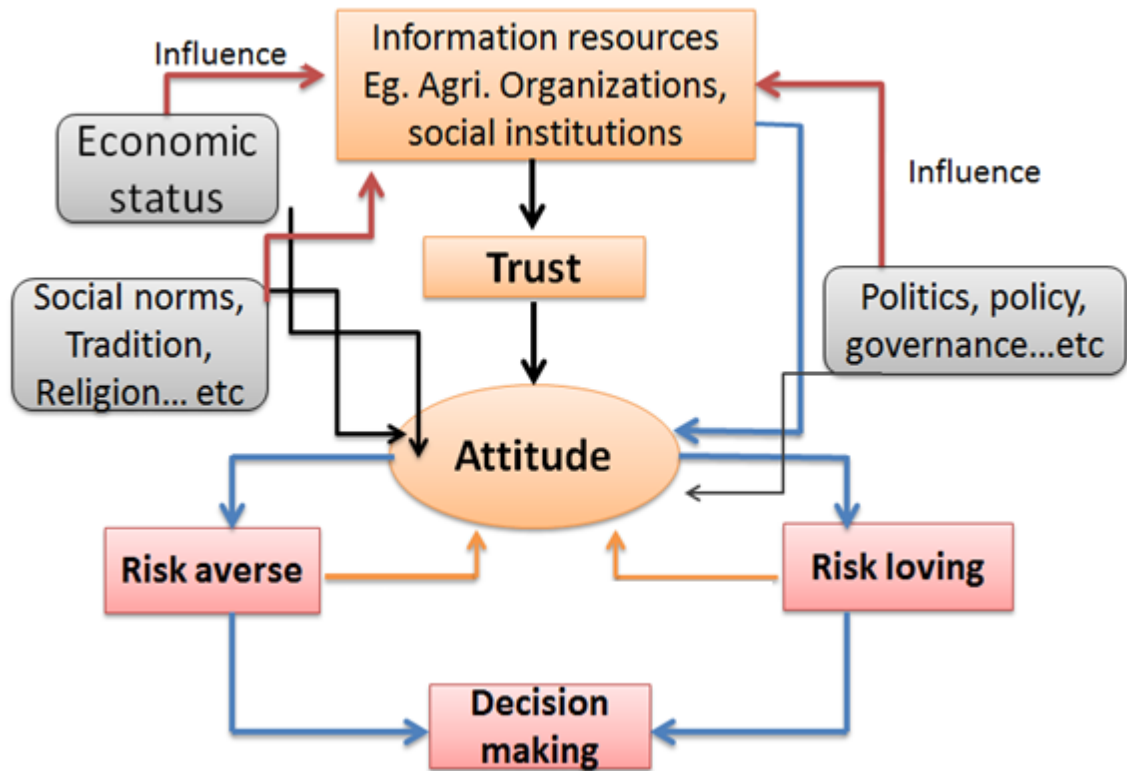
Figure 2 Risk attitude and the determining factors framework

Risk attitude is not only determined by the trust we develop, it is also directly influenced by the elements of socio-economic performance and the nature of governance that a nation follows. For example farmers in developing countries are financially poor to afford new technological innovations (improved seeds, fertilizers and micro irrigation technologies). The inability to adopt technologies holds them back from external interactions, limiting their activities and social interactions to their environments. Innovative technologies often improve farmers understanding about their farm system. It provides them with selecting the right amount of fertilizer application, type of crop cultivation, water use management. However if farmers fail to employ the technologies that brings about change in their productivity, there is hardly improvement in their annual yields. Studies show that farmers in rural areas of Kenya with financial

17

tribulations are less interactive, which makes them to stick to their traditional system of agriculture (Wittich, 2015). For example, farm planning, contact with the buyers; commercially oriented farming practices are poorly managed. Governments in developing countries often spend their resource to control the life of rural people, to strengthen their quest of political domination. One of their best tools is the land tenure issue. In Ethiopia land had been controlled by imperialists and elites for centuries and still continues to be a state owned property since the down fall of the imperial system. However nowadays farmers in rural areas of Ethiopia are granted a life time land holding certification without being able to sell it (Ambaye, 2012). The report suggests that due to the restrictive nature of the rural land assertions, farmers are not able to actively engage in their land (e.g. they cannot rent it when they need it; they cannot pass it to their family members as inheritance). These restrictions affect the farmers' attitude negatively, hampering them from farm development and expansion.

The conceptual framework summarizes what the study mainly focuses on and the links between different segments of the determining factors. Other indicators and predictors of risk attitude are explained in the results and discussion section in broad sense. In addition, we use Fukuyama's (2001) simple theoretical network of trust to show the importance of trust as important ingredient in developing the social capital of groups and its optimism that leads to riskier portfolio (see the next section).

3.2 Trust and the Social Capitals

A very good definition of the social capital is given by Bourdieu (1986) saying that 'social capital is an attribute of an individual in a social context. One can acquire social capital through purposeful actions and can transform social capital into conventional economic gains.' Economic and cultural capitals can be explained by social capital where social networks are paramount to their existence. The formulation of the term fits the economic behavior of individuals. The decisions made by individuals are determined to some extent by the strength and the type of connections created for their community. In a different perspective Fukuyama (2001) approaches the social capital through the concept of the 'radius of trust.' He said that social groups such as tribes or village associations embody social capitals that can reach at certain boundaries that are measured by the radius of trust (see figure 3). The small black spots

18

represent the groups of people and the circle around them, within which the radius of influence of the social capitals can reach. If the social capitals of one group foster positive attitude toward the outsiders, the radius of trust can be reach beyond the group's periphery, increasing individual's decision making abilities to make connections with the outsiders. However, in closed or more conservative societies the attitudes could be hostile to other communities and thus the radius of trust is limited within the group. For example the traditional Ethiopian social groups are developed based on deeper convictions of the shared norms and cultural practices that keep them dependent on each other. Most of the time such organizations have less trust on the outsiders and thus the interaction is very low. This may have a negative effect on the overall economic and political life of the society. Distrust among different groups of people causes conflict of interest and class of domination among societies that eventually led to self-disinclination and contempt against the outsiders. Uslaner (2005) underline the importance of trust in economic and social outcomes of people saying that 'it is a reflection of the bond that people share across a society and across economic and ethnic groups, religious, and races.'
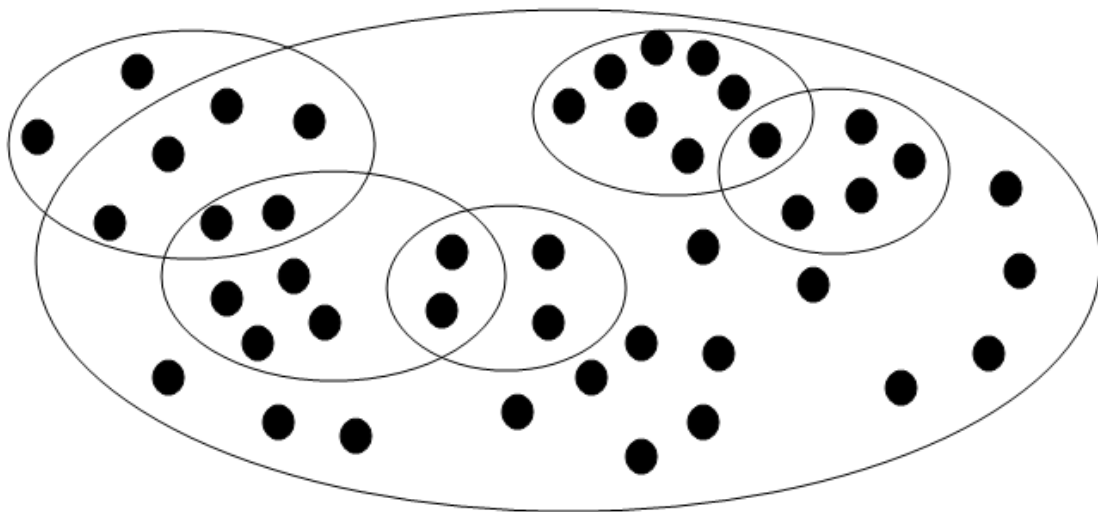
Figure 3 Network of Trust (Social groups and the radius of trust)
Source: Fukuyama (2001)

Hence societies which do not possess these values end up in political upheavals and corruption, losing their social values that bring them together. Besides, general trust among groups promotes the cognitive social capital that is believed to be crucial for communication between two actors for economic and social progress (Knack & Keefer, 1997). In Fukuyama's study of trust the term 'weak ties' is explicitly explained to compare traditional and modern societies which were thoroughly studied by Granovetter in 1970s (Granovetter, 1973). 'Weak ties' refer to individuals or groups of people whose activities are stepping up micro-level interactions of people to macro-level patterns. These people usually live at the peripheral village area and they create a room for exchanging new ideas and information between different groups of people. Traditional societies often constitute the same type of people like most of the rural Ethiopian tribal groups. On the other hand modern societies are composed of different social groups that consent to multiple identities that respect equal right to every group in which information and new ideas are relatively easier to circulate between groups that connect with people outside of their community. In general Fukuyama's research approach proves that societies with efficient trust network increases individual and group predictive stability, promoting socio-economic values that enable people to adopt and integrate new technologies for their own benefit.

Woolcock (1998) argues that trust is better understood as a measure of social capital rather than considering it as a social capital per se. People engage themselves to social networks to receive trust among the group that actually determine the amount of social capital acquired in the group. Putnam (1993) agrees with Woolcock's argument and says that trust could be considered as a proxy to social capitals. It can be also related to economic performance of the people where trust is perceived as an asset in an organized society in day-to-day activities.

But how can trust affect the economic activity of a society? It is a question that has to be properly addressed to explain the cause of our focus. People's economic activities are often accompanied by trust and trustworthiness for mutual growth. Arrow (1972) says that commercial transactions between different groups of people always have trust as an informal patron to sustain the exchanges. For example investments and savings decision of people depend on government policies and legitimacy to protect

20

them from the bank's exploitation or confiscation of the assets. In higher-trust societies instead, people use trust to build confidence and thus depend on trust as a guarantee from being abused in economic transactions. Litigation and breach of law are less likely to happen in such societies. Hence additional expense on private security through bribes and tax payments are rarely seen. The existence of higher levels of trust minimizes people's dependence on formal institutions. This is particularly beneficial in rural areas like Ethiopia where the people have less access to technology and educational opportunities that are basic to complex credit markets. In situation where government institutions are unwilling to enforce contacts or if they demand excessive administration costs, inter-personal trust between different individuals do great job (Knack & Keefer, 1997).

Trust does not only decrease the transaction costs and dishonest between two actors, it also improves the social values of the society. It increases the chances of poor people to get access to credit and social support from the community. Social network and trust are highly correlated with the institutional functioning of a government and higher-quality of schools in a country (Coleman, 1988; Putnam, 1993). This is also supported by the study conducted by Knack & Keefer (1997), saying that societies which are characterized by poor-trust, institutional works are highly influenced by personal desires, family kinships and blood ties and less by educational credentials, eroding norms and destroying the social fabric of the societies. Trust improves the political participation of the people in a community, increasing public discussion and political awareness of the people. This creates a platform where the public can hold government institutions and political elites into accountable whereby influencing government policies for efficient leadership. Putnam (1993) clearly shows this in his study, comparing the effectiveness of the regional governments in the more-trusting and more civic-minded people Italians in the northern to the less-trusting societies of the southern counter parts. He found out that people in the north have better government administration than the southerners. Moreover the people with higher-trust behavior have better understandings of government programs and they discuss by public issues. They obey laws and are active in political life of the region. The social and political lives of the people are organized horizontal and people are not polarized vertically. On the other hand people at the other pole have hierarchical social organizations and people

21

are highly engaged in narrow national and personal issues where majority of the people felt exploited and disregarded in many ways. For example, people are deliberately excluded from the political and economic participation of the region.

The above studies and the theoretical deduction of the social capitals underline the importance of the embedded trust to influence the attitudes of people to take decisions on economic and social affairs. With this we proceed directly with the methodologies and procedures that we follow to carry out our study.

Methodology

3.3 The Study Area

The study is conducted in the southern part of Ethiopia. The area has an altitude ranging from 1,500 meters to 3,500 meters above sea level. It covers extensive area with a radius of 200 km from the main city Hawassa. A total of 258,808 people live in this region and 61% of them reside in the city and the rest of the population live around the rural administrative area locally called Kebeles[5]. Five major ethnic groups live in this zone namely, Sidama, Amhara, Welayta, Oromo and Gurage and most of them are subsistent farmers (Gibson et al., 2009). They grow several crops and coffee is a popular agricultural product in the area and cattle are considered as a measure of wealth among the people. Coffee and livestock products are the main sources of income for the region beside to off-farm activities and remittance.

3.4 Data Collection

The household survey was conducted in 2012. The survey covers different agro-ecological areas of the country and the questions were prepared to capture the socio-economic characteristics of the households. The 404 interviewed households in this study reflect a sub-sample of a nationally representative baseline survey conducted by International Food Policy Research Institute (IFPRI) in 2012 for the Ethiopian Agricultural Transformation Agency (ATA). The research area was limited to a ca. 200 kilometer radius around the city of Hawassa. This area reflects a substantial variation of

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[5] Kebeles are the smallest administrative units in Ethiopia

22

altitudes and hence agro-ecological zones. Considering our focus on the risk game, we had to limit the analyses to those 385 households who participated in the game. Nine out of the 404 subjects are excluded from the game due to improper response to the game. For example some of subjects start with risky bet and then switch to safe bet and then again to risky bet which is not a rational way of choosing the bets. Similarly some of the interviewees choose the risky choice with a maximum payout, when they could get the same amount in the safe option. Therefore we conclude that these participants do not

3.4.1 Theoretical Specification

Individuals' risk preference has no specific rule or equation to determine the end result. However a general equation can be inferred from the previous empirical works and literature reviews to answer our questions.

Risk decision = f (Education level, Age, Number of Shocks (flooding, drought), gender of the household respondent, trust in relatives, etc). Our predictors are selected based on theories, experiences of the previous studies and the socio-economic performance of the people in southern part of Ethiopia. The following topics discuss the importance of the chosen variables and their measurements based on a given function.

3.4.2 Independent Variables and Hypothesis

Even though there is no stature methods that should be followed to precisely choose the independent variables, we can select the independent variables based on the theoretical deductions and previous results of similar studies. However the problem of irrelevance and insignificance of certain variables out of the chosen sets continue to appear in our analysis. For example if the selected variable is assumed to be the best explanatory variable and is used in our regression model, the variable could be insignificant in our result. But early elimination of the variable from our model may have a consequence. It can affect negatively on the other independent variables that are highly significant in our result. On the other hand some variable may not be significant in survey collected response but significant in experimental studies that includes incentives. Besides, selecting large number of independent variable does not always

23

increase the chances of strong model (e.g. decreasing the p-values and coefficients of the variables). Increasing the number of independent variables in a chosen model is considered as a good technique to get substantial number of significant variables; however this method implies the weakness of our econometric function and our inability to choose the right one. One of the problems is multicollinearity. Multicollinearity is a term used to describe, when two or more predictors are strongly correlated to each other to measure the same dependent variable. In such circumstances it is difficult to tell which of the two predictors affects the results at the end. Generally, an increase in the number of exogenous variables could give us higher percentages of R-squared; however it can also decrease the precision of our estimates. Our selection method cogitates the above limitations and and their respective consequences. Hence we add relevant and explanatory variables to estimate our result. The next sections provide the explanation and justifications for the selection of variables in our regression analysis.

Table 1 Description of variables and their measurement

Variables	Description	(N= 404)		(N= 385)	
		Mean	Std. Dev.	Mean	Std. Dev.
Dependent variable					
Willingness to take risk on farm management	Scale 0-9 0= risk averse and 9= risk-taking	6.2	2.0	6.5	2.4
Independent variables					
Trust in relatives	Scale 1-5 1= strongly disagree, 2= Disagree, 3= Neutral, 4= Agree and 5= Strongly disagree	3.84	0.72	3.85	0.71
Gender of the household respondent	Dummy= 1, If male, 0 otherwise	0.83	0.37	0.82	0.38
Education level	Years of formal schooling	3.24	3.65	3.25	3.66
Respondent household	Dummy= 1, If household head, 0 otherwise	0.89	0.31	0.89	0.30
Number of shocks (past 5 years)	The frequency of occurrence	0.35	0.57	0.34	0.56
Total off-farm incomes	Total income from non-farm activities in Birr[6]	2600	0.67	2700	0.69
Whether the HH obtained a loan	Dummy= 1, If the HH obtained a	0.14	0.01	0.14	0.35

[6] Birr (ETB) is the unit of currency in Ethiopia

Table 1 (Continued)

Variables	Description	(N= 404)		(N= 385)	
		Mean	Std. Dev.	Mean	Std. Dev.
	loan in the last 12 months, 0 otherwise				
Marital status	Dummy= 1, If married, 0 otherwise	1.91	1.95	1.92	1.98
Informal schooling	Dummy= 1, If HH received informal schooling, 0 otherwise	0.04	0.21	0.04	0.20
Help from someone	Dummy= 1, If the household respondent asked anyone for help (cash, food) from, the past 12 months	0.21	0.41	0.22	0.41
Parcel distance	Time taken to reach agricultural parcel from home of the household (minutes)	15.43	27.14	15.55	27.20
Age of the HH respondent	Age of the respondent in years	44.37	13.95	44.31	14.05
Informal information	Dummy= 1, If the respondent used any informal information (from friends, neighbors, Baito) in the past 12 months, 0 otherwise	0.36	0.48	0.37	0.48
Number of people the HH rely upon	In case of any problem/emergency, how many people can the household rely on (in numbers)	9.33	21.89	0.22	0.42

Table 1 (Continued)

Variables	Description	(N= 404) Mean	(N= 404) Std. Dev.	(N= 385) Mean	(N= 385) Std. Dev.
Household visited by the extension agent	Dummy= 1, If the HH is visited by the extension agent, 0 otherwise	0.70	0.45	0.71	0.45

Notes: N= 404 and N= 385 represent the number of observations in survey questionnaire and game respectively. Nine interviewed households are eliminated during the experimental analysis due to inappropriate response to the game.

3.4.2.1 *Trust in Relatives*

The Ethiopian families and the households are formed in an intertwined socio-economic support (Abebe, 2008). In an extended family life, one has to contribute to the large family to be treated the same way as the other members. The social support to relatives or family members is a social obligation where every member has to contribute a helping hand as much as possible. This implies the existence of the reciprocity within the family members. For example if there is cultural ceremonies in the family, everyone is expected to join the social gatherings. Religious celebrations, funerals, weddings are some of the social ceremonies common in Ethiopia. The joint effort for a common cause creates a strong relationship among the families that all the members feel the trust of one another. Eckel & Wilson (2003) conducted a series of experimental studies at Virginia Tech and Rice University, USA. The main objective was to find out the relationship between the risk attitude and the decision on trust and they reported that the trust of the subject has no direct relationship with risk preference. They stated that, subjects seek information about their counterpart in order to make decisions. Hence based on the given information about the subject's sex and ethnicity the study concluded that trust has no significance on the risk decision of the subjects. However based on the social organization and integrity of the Ethiopian people, our hypothesis is quite the opposite to their findings that 'trust in relatives' as a predictor has a positive correlation with the risk attitude of the individuals. We ask our respondents if they have ever relied on family members or any other person when they need anyone for their ultimate support. Our hypothesis is that as the number of people that the household rely upon increases the risk-taking attitude of the household increases too encouraging them to take risky decisions in an uncertain situation. Help from someone in terms of food and goods within the last twelve months capture how much the respondents are affected within short period of time on their willingness to take risks. We believe those who receive support from their relatives are more risk takers than those who do not receive any at all. We are going to use Ordinary Least Square and Probit models to analyze the response to trust in relative question. In OLS we use the original score of 'trust in relatives' which is from 1 to 5. But in Probit model the scores have to be in the form of binary numbers (0= no and 1=yes). The scores between 1 and 3 are considered as 0

28

which means no to the question of trust in relatives and the scores between 4 and 5 as 1 that is yes.

3.4.2.2 Education Level

Education is generally considered as an investment that has higher returns in the future. Education is virtually one of the fundamental platforms that improve the capability of the households to evaluate the risks. A number of studies claim that education and risk attitude are highly correlated. Jung (2014) wrote that risk altitudes of individual are highly correlated with their educational background. Based on the data collected during the 1973 British Education Reform, the result uncovered that a one year increase in education level among the Brits is positively correlated to risk aversion attitude. However in our study we choose to differentiate between the formal schooling and the level of education of the respondents so that our sample represents all subjects including those who have not reached the high school level or beyond. The people of the southern part of Ethiopia have lower access to education. Based on our descriptive results the larger part of the representatives did not have formal education. As a result we considered that it is crucial to include the question that asks 'if the respondent has ever attended formal schooling' before we proceed with the level of education they attend.

As education is always assumed to have a positive impact, we hypothesized that both having formal schooling and the level of education that households maintain has positive impact on risk seeking attitude of the respondents. This is due to the ability of the respondents to assess the impact of the risk decisions.

3.4.2.3 Source of Information

As we have already pointed out in our conceptual framework, the source of information in risk attitude is highly appreciated by Eiser, Miles, & Frewer (2002) stating that the nature of information has direct effect on the public risk perception. There are different sources of information through which farmers can collect and utilize them. For example people in rural areas of Ethiopia often get their information informally. When there is an urgent need for information and knowledge on harvesting

29

time, type of crops to grow and market price, farmers usually refer to their close friends, relatives, and social groups. These types of sources provide informal information to the households. There is a general believe in the public that people in rural areas have a great deal of trust on their relatives and friends that help them to make risky decisions. The conceptual framework in figure 2, illustrates how the trust is established to influence the risk attitude of individuals. Nowadays farmers use mobile phones to exchange information. Due to the fast growing information technology farmers in rural areas are getting access to mobile phones at a faster rate. A study shows that majority of the rural people in Africa are mobile users and there is a record that shows Africans are the fastest mobile subscribers in the world (Sood, 2006). This shows mobile phones are becoming one of the key communication tools in rural Africa. Mobile phones can receive, process, display images and record sounds that farmers need them to increase their knowledge and understanding for better outcome. Based on their positive impact, we hypothesize that mobile ownership encourages farmers to take risk to a certain level, because it allows them to get the necessary information so that they can understand the pros and cons of a risk decision they would take at a time.

In addition to mobile phones, households can receive information from the extension services. The role of an extension agent is to teach households about farm management and working to bring behavioral change and transform the life of farmers. An experimental study conducted in Ethiopia on a risk preference of the households on the adoption of soil conservation methods demonstrate that extension service has a positive impact on risk seeking attitude of the famers (Teklewold & Köhlin, 2011). Similarly Yesuf & Bluffstone (2008) argued that the use of extension measures in their studies entail success that farmers were comfortable with risk taking decision. Similarly we believe that the subjects in our sample would increase their risk seeking attitude with the quality of knowledge they obtain about farm management.

3.4.2.4 Gender of the Household Respondents

Gender is an exogenous variable. It has been widely used as an independent variable to determine its significance on the risk attitudes of the households. It is also used to gauge how the gender disparities of one society affect the economic and social activities of the households. A previous study indicates that women are less willing to take risks in

general (Dohmen et al., 2011). In another study which is conducted in 2006 it is reported that women have less risk taking behavior than men (Dohmen, Falk, Huffman, & Sunde, 2006). The study further underlines that the result explains gender difference in decision makings. The implications are also explained in another important experimental research saying that women did not show willingness on decision makings that involves risky situation (Niederle & Vesterlund, 2005). Based on these evidences and the traditional perception of the Ethiopian culture where male dominates over female, we assumed that men are higher risk takers than women. On a similar assumption, age is also an important factor in determining risk preference of the individuals. As the age of the household respondent increases, the willingness to take risk decreases accordingly.

3.4.2.5 Shocks

Shocks in different forms (e.g. floods, chronic disease, pest attack, drought and others) have been identified to expose rural households to poverty (Hulme & Shepherd, 2003). A number of studies have been carried out to gauge the impact of shocks on rural people. The unpredictable nature of the shocks usually motivates researches to peruse the studies to find out more on the nature the shocks and their effect on farmer's attitude. People who live with shock prevalence have a very slow economic growth that might last longer than expected (Elbers, Gunning, & Kinsey, 2007). Another serious consequences of the shock is when individuals aim to initiate a plan on investment, they are often overwhelmed by the previous experiences that deter them from taking steps to plan execution. This term is deterrence is usually termed as 'background risk' (Harrison & Klein, 2007). In this study it is noted that the vulnerability and poverty are not just exacerbated directly by the impacts, rather the shocks caused the instigation on risk taking attitude of the people that reduces them to poverty. Our hypothesis do not differ from the previous assumptions and findings made by other researchers, and based on their reports we predict that, as the number of shock experience increase the farmers develop risk aversion attitude.

31

3.4.2.6 Total Non-farm Incomes and whether the HH obtained a loan variables

Farm households work almost entirely on farm, paying little attention to rural non-farm activities (Barrett, Reardon, & Webb, 2001). However non-farm activity is also equally important as a source of income in rural areas. Farmers who are engaged in self-employment, manufacturing and other public services receive considerable amounts of income to cover their family's expenditure on food, medication and other necessities. The effect of non-farm income in risk attitude of the rural households has been studied in different countries. For example a study conducted in Abia (one of the states of the federation of Nigeria) in a group of 97 smallholder farm households, found out that individuals' off-farm income increases their willingness to take risks on decision makings (Amaefula, Okezie, & Mejeha, 2012). In 2011, similar results were reported by Picazo-Tadeo & Wall (2011) in a study which is carried out on rice producing farmers in Valencia (eastern Spanish region). Our study recognizes the benefits of non-farm income in rural farm households and it assumes that risk aversion attitude of the households' decreases as the number of non-farm income activities increases.

Rural households take loans from governmental and non-governmental institutions due to an increasing price of inputs that are necessary to make a living. Due to the growing economies and the increase in farm materials (e.g. fertilizers, high costs of seed and labor) farmers are often obliged to borrow money to cover the costs. Even in uncertain situations, farmers have to continue to invest in their farm land to secure their produce which eventually put them into an increasing debt. Intuitively, taking loans and become indebted has always negative impact on economic growth of in rural livelihoods. Hence our study considers that farmers who have taken loans exhibit risk aversion attitude.

3.4.3 Willingness to Take Risks and Hypothesis

Our study aims to identify the main factors that affect the risk attitude of the Ethiopian households. To get reliable answers the respondents are asked a general risk question that is related to their routine activities. The questions includes about their willingness to take risk on farm management such as planting date, choice of crops, amount of fertilizer use etc. The respondents receive enough information on how they

should respond to the questions. A risk scale is prepared between 0 as fully avoiding risks and 9 as fully prepared to take risks. The households have to select one value out of the ten choices. The general risk question has been used before to predict the actual risk taking-attitude of rural people. A famous example is the an experimental study conducted by Dohmen et al. (2011) to find out the determining factors of the risk attitude of the 11,803 different households in Germany. The study used the general willingness to take risk on different sets of dependent variables to determine the factors of risk attitude of the households. However before model specification and complete analysis was conducted the study tests the validity of the survey based data measures. After proving the validity of the survey measure using the game risk response, the study found out that 76% of the households in the study area exhibit risk aversion attitude. Similarly it is important to prove the validity of the survey measures we use in Ethiopia before we conclude on the results.

In general our study follows similar procedure to the above, asking the subjects about their willingness to take risks on farm management (see appendix D: section E). To avoid confusion and ambiguity the subjects are asked specific questions, to respond on planting date and the choice of crops for cultivation which are common agricultural activities in Ethiopia. An experimental study using lottery game is conducted to make sure the survey study offers valid results. Each participant is provided with two options. The players can bet on sure payment or to bet on risky prospect. In the risky game each household has to draw a ball from a white bag with 5 green and 5 yellow balls. If they guess the right ball, they win 20 ETB otherwise they get nothing. The experiment prepares 10 choices in an orderly list, so that the participants can choose between fixed payment and playing the game. Along down the list, the fixed amount increases from 1 ETB to 20 ETB. Most of the subjects would prefer to play the game if the sure payment is very small, but they will choose the fixed payment if the amount is big. But at some point they will switch from betting on the game to fixed payment apparently. Therefore, it is this switching point question that actually measures the risk attitude of the subjects which is 10 ETB (see appendix D: section E). The lottery game is provided with real money at stake, to give us incentive compatible measures of risk attitude in our sample. Lottery games reduce individual's biased respond, strategic motives and other intentional choices during the experiment. Then Probit and OLS models are employed

to empirically analyze the data. The merits and demerits of both models are explained above (see section 4.3.1 and 4.3.2).

The next sub-sections explain the model specification method, the assumptions and the importance of each model in the analysis.

3.5 The Models and the Robustness Check

The factors that affect the risk attitude of the Ethiopian people were analyzed using two econometric models. Probit is one of the commonly used models for binary outcomes. Probit records events as binary figures, 1 as the occurrence of the result and zero otherwise, however the OLS can give results beyond the binary outcomes.

3.5.1 Probit

Probit and Logit models are among the most widely used models for binary outcomes in applied economics. Basically both of them have the same application with the same output that is either 0 or 1. However their usage is highly influenced by the traditional practices. For instance Probit models are often used by economists while Logit model is usually used in biological and social sciences. Both models can take any ordinal numbers and rescale it produce binary results. Probit and Logit models can be also differ on how the function $f(*)$ should be defined. For example the Probit model uses cumulative distribution function (cfc) of the standard normal distribution. On the other hand for the Logit model the $f(*)$ the cdf of the logistic distribution. The predicted probability for both models is limited between 0 and 1. Therefore for any $\alpha + \beta x$ value it is transformed by the function to fall between 0 and 1. The following two functional forms of Probit and Logit models represent their statistical expression that attribute to their main difference (Powers & Xie, 2000; Scott Long, 1997).

3.5.1.1 Probit Model

$F(x'\beta) = \Phi(x'\beta) = \int(z)dz x'\beta - \infty$

Here $\int(z)dz x'\beta - \infty$ would be the probability where $F(x'\beta)$ is equal to 1 and the probability for the function equals to 0 would be $1 - [\int\Phi(z)dz x'\beta - \infty]$.

34

3.5.1.2 Logit Model

$$F(x'\beta) = \Lambda(x'\beta) = \frac{e^{x'\beta}}{1+e^{x'\beta}} = \exp(x'\beta)\left(\frac{1}{1+\exp^{(x'\beta)}}\right)$$

Similarly the probability of the Logit module to become 1 is $\frac{e^{x'\beta}}{1+e^{x'\beta}}$ and the probability it becomes 0 is $1 - \left[\frac{e^{x'\beta}}{1+e^{x'\beta}}\right]$.

Dohmen et al. (2011) and Yesuf & Bluffstone (2008) employed Probit model to find out the risk aversion attitude of the households. Hence based on these experiences and some standard assumptions we prefer to use Probit to Logit model. The statistical model is expressed as the probability y = 1 as a function of the independent variables.

$$P = pr(y = 1|x) = F(x'\beta)$$

Based on the above expression, the Probit model gives the advantage that the outcomes are either 0 or 1. In this model the interpretation of the coefficient accounts for its sign (positive or negative), but not magnitude, and this is because different models have different scales of coefficients.

Probit regression needs certain assumptions that attribute its use like any other model. It requires bivariate normality and the residuals have to be checked against the bivariate normality (Wooldridge, 2010). Other assumptions are inevitable. For example the results of the dependent variable should be expressed in binary figures. But the shortcoming of the model is that it reduces ordinal variables to binary level, undermining the actual meaning of the other representative values of the variables contained within it. For example, the continuous form of dependent variable in OLS model should be converted to binary form to use it in Probit model. This makes the Probit inferior to other statistical models. In a Probit regression that assumes P(Y =1), the probability that we have a positive result, the dependent variable must be depicted accordingly. In other words, in dichotomous outcome the level 1 should be allocated the desired outcome. It is also necessary to check whether the model is fitted correctly. All meaningful variables should be included but with neither over fitting nor under fitting.

Hence our model should follow the stated assumptions to provide us a meaningful estimation in both survey and experimentally collected data analysis.

35

3.5.2 Ordinary Least Square (OLS)

The OLS can be used to analyze the scores that are collected using the survey method as well as experimental method with a real money at stake. Our data comprises two sets of collection, to test the risk attitude of the Ethiopian households using survey method and lottery game. We analyze them using OLS regression. However in order to come up with robust and credible results, first the OLS assumptions have to be clearly explained. Even though a number of studies underline the importance of normality in multiple regression analysis, the assumption has to be for a valid hypothesis testing. This means the normality assumption is used to validate the t-test and F-test using the P-values. But more importantly the residuals (errors) should be identical and independent. Homoscedasticity of residuals refers to the variance of residuals, when there is a pattern that the residuals are plotted against the fitted values then we consider the variance of residuals as heteroscedastic. There are two ways to test for homoscedasticity (the White's test and Breusch-Pagan test). In both tests the null hypothesis is measured to check if the variance is homogeneous. In this particular measure, if the P-value is very small then we reject the null hypothesis. Multicollinearity occurs when more than two predictors are highly correlated to each other to destabilize the coefficients of the estimate and thus the standard errors would get highly overstated. The degree of collinearity is the main concern when the regression result is to be tested for its multicollinearity. The degree of tolerance is measured by 1/VIF (VIF stands for variance inflation factor). According to (Chatterjee, Hadi, & Price, 2000) the value of VIF < 10 has no problem. But this is only true when our objective is to predict or estimate the dependent variable. However our study aims at analyzing the relationship between dependent and independent variables, and thus there is a need to eliminate some independent variables subjectively, that are assumed to capture less on the variability of the dependent variable in question.

The OLS model can be expressed statistically as under:

$$y = \beta_\circ + \beta 1 x 1 + u;\ y = \beta x' + u$$

Where

y is the dependent variable (predicted or response variable)

x is the independent variables (control variables or repressors)

$\beta_{\circ}$ is the intercept; $\beta 1$ is the slope; U is the error term or disturbance