Zentrum für Entwicklungsforschung

Social interactions, aspirations, and agricultural innovations

Linkages with income and food security in rural Ethiopia

Inaugural – Dissertation

zur

Erlangung des Grades

Doktor der Agrarwissenschaften

(Dr.agr.)

der

Landwirtschaftlichen Fakultät

der

Rheinischen Friedrich-Wilhelms-Universität Bonn

von

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Raya-Kobo, Ethiopia

Bonn 2016

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Tag der mündlichen Prüfung: 07.10.2016

Abstract

The persistence of poverty in some parts of the society across the globe inspired recent studies in development economics to embrace the use of multidisciplinary tools and concepts to better understand the situation of the poor. This thesis employs one of the recent conceptual tools, the aspirations-failure framework, which links the situation of the poor and their (under)investment behavior to aspirations failure. Based on individual and household level data collected from a sample of farm households in rural Ethiopia, the thesis first econometrically examines the effect of social interactions on aspirations (with respect to income, wealth, social status and education). The findings are in line with the theory which suggests that aspirations are socially determined through observations and social interactions. In particular, results indicate that social network size is an important determinant of aspirations and especially that of women's, attesting to the importance of widening the 'aspirations window' – a person's cognitive world that shapes their aspirations.

One of the channels in which aspirations may affect behavior is through their effect on risk aversion. The thesis finds that the 'aspirations-gap' (AG) – the difference between the aspired and present status – indeed relaxes risk aversion, and the association is non-linear. Results also indicate that the effect of AG on risk preferences is stronger for women.

Social interactions may also enhance diffusion of innovations and productivity. Based on social networks data collected using 'random matching within sample' procedure, the thesis identifies strong evidence of network externalities in the adoption of row-planting and also in farm productivity. The novelty of the thesis is also the identification of aspirations (or AG) as one of the key determinants of farmer innovativeness or the adoption of innovation products such as chemical fertilizers.

The main goal of the thesis is ultimately to try to understand the implications of aspirations by examining their interactions not only with the underlying drivers of well-being (such as the adoption of agricultural innovations and risk behavior) but also their interactions with the well-being outcomes themselves. The thesis uses various outcome indicators including income and consumption expenditure, various triangulating measures of food security, and subjective well-being defined in terms of life satisfaction and happiness. In nearly all outcome indicators, the thesis finds suggestive evidence that aspirations are important predictors of household well-being in rural Ethiopia.

The overall findings of the thesis clearly demonstrate that beyond the resource-related deprivations, low aspirations (or aspirations failure) also play a role in rural households' decision-making in Ethiopia, with consequences on well-being outcomes. Targeting the determinants of aspirations may therefore be a useful policy strategy. This is because moderately raised aspirations may also help improve the effectiveness of other policies aimed at improving the adoption of agricultural innovations and well-being outcomes in rural Ethiopia. The key messages of this study can be seen as support for the recent call of the World Bank for a new set of development approaches, "viewing people more fully and recognizing that a combination of psychological and social forces affects their perception, cognition, decisions, and behaviors", as formulated in the world development report of 2015.

Zusammenfassung

Entwicklungsökonomische Studien greifen immer häufiger auf multidisziplinäre Methoden und Konzepte zurück, um ein besseres Verständnis über die anhaltende Armutssituation in Teilen der Welt zu erhalten, greifen. Die vorliegende Arbeit verwendet ein solches Konzept, das *aspirations-failure framework*, das die Situation der Armen und ihr Investitionsverhalten mit dem „aspiration failure" verknüpft. Anhand von Individualdaten und Haushaltsdaten von landwirtschaftlichen Betrieben in Äthiopien wird der Effekt von sozialen Beziehungen auf Aspirationen (in Bezug auf Einkommen, Wohlstand, sozialer Status und Bildung) ökonometrisch analysiert. Die Theorie besagt, dass Aspirationen gesellschaftlich bedingt sind, beispielsweise durch gegenseitige Beobachtung und durch soziale Interaktionen. Die ökonometrischen Ergebnisse bestätigen dies. Tatsächlich deuten die Ergebnisse an, dass die Größe der sozialen Netzwerke eine wichtige Determinante für Aspirationen insbesondere von Frauen ist. Auch die Relevanz des *aspiration window* wird bestätigt – dies ist die individuelle kognitive Welt, die Aspirationen formt.

Ein Wirkungskanal, durch den Aspirationen das individuelle Verhalten beeinflussen können, sind die Effekte auf das Risikoverhalten. Die Analyse macht deutlich, dass der *aspiration-gap* – die Differenz zwischen angestrebten und gegenwärtigen Status – das Risikoverhalten in einer nichtlinearen Weise beeinflusst. Die Ergebnisse deuten auch an, dass der Effekt des *aspiration-gap* auf die Risikopräferenz bei Frauen stärker ausgeprägt ist als bei Männern.

Darüberhinaus können soziale Interaktionen die Verbreitung von Innovationen und die Produktivität fördern. Die Analyse von sozialen Netzwerken, die die Methode „random matching within sample" nutzt, zeigt einen starken Einfluss von Netzwerkexternalitäten auf die Adoption von Sätechniken sowie auf die landwirtschaftliche Produktivität. Entsprechend trägt diese Arbeit maßgeblich zur wissenschaftlichen Diskussion bei, indem Aspirationen (und deren Lücke) als Schlüsselvariable für die Innovationsfähigkeit der Bauern identifiziert werden und diese die Adoption von innovativen Produkten wie zum Beispiel chemischen Düngemitteln erklären können.

Das Ziel dieser Arbeit ist es, die Implikationen von Aspirationen zu verstehen. Dazu werden die Interaktionen mit den grundlegenden Determinanten des Wohlbefindens untersucht (beispielsweise die Adoption von landwirtschaftlichen Innovationen und das individuelle Risikoverhalten) und die Interaktionen mit den direkten Folgen des jeweiligen Wohlbefindens. Verschiedene Outcome-Indikatoren werden verwendet, wie unter anderem Einkommen und Konsumausgaben, verschiedene triangulierte Food Security Indikatoren, sowie subjektives Wohlbefinden, das als Zufriedenheit und Glücksempfinden definiert ist. Für fast alle Outcome-Indikatoren wird ein Einfluss von Aspirationen auf das Wohlbefinden von ländlichen Haushalten in Äthiopien gefunden.

Diese Arbeit zeigt auf, dass neben Ressourcenengpässen insbesondere auch nicht vorhandene Aspirationen (oder das Scheitern von Aspirationen) eine entscheidende Rolle im Entscheidungsverhalten von ländlichen Haushalten in Äthiopien spielen, mit entsprechenden Konsequenzen für das Wohlbefinden. Folglich kann es eine erfolgreiche Policy Strategie sein, die Determinanten von Aspirationen zu berücksichtigen. Mit leicht gehobenen Aspirationen könnte nämlich die Effektivität von Policies verbessert werden, die eine Steigerung der Adoptionsrate von landwirtschaftlichen Innovationen bewirken sowie das Wohlbefinden im ländlichen Raum Äthiopiens verbessern. Die zentrale Aussage dieser Arbeit steht somit im Einklang mit dem im World Development Report 2015 veröffentlichten Aufruf der Weltbank für einen neuen Entwicklungsansatz: „viewing people more fully and recognizing that a combination of psychological and social forces affects their perception, cognition, decisions, and behaviors".

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Acronyms

AG	Aspirations-Gap
2SLS	Two-Stage Least Squares
ATE	Average Treatment Effect
ATET	Average Treatment Effect on the Treated
ERHS	Ethiopia Rural Household Survey
ETB	Ethiopian Birr
FAO	Food and Agricultural Organisation
FCS	Food Consumption Score
FNS	Food And Nutrition Security
FTC	Farmer Training Center
GDP	Gross Domestic Product
GFDRE	Government of the Federal Democratic Republic of Ethiopia
HABP	Household Asset Building Program
HDDS	Household Dietary Diversity Score
HFIAS	Household Food Insecurity Access Scale
IFAD	International Fund For Agricultural Development
ISC	Innovation Systems Concept
KM	Kernel Matching
LIML	Limited Information Maximum Likelihood
MFI	Micro-Finance Institution
MOFED	Ministry of Finance and Economic Development
MPI	Multidimensional Poverty Index
NGO	Non-Governmental Organisation
NN	Nearest Neighbor
OECD	The Organisation for Economic Co-Operation and Development
OLS	Ordinary Least Squares
PPP	Purchasing Power Parity
PSM	Propensity Score Matching
PSNP	Social Safety Net Program
SNRMPs	Sustainable Natural Resource Management Practices
UN	United Nations
USD	United States Dollar

Acknowledgements

I would like to thank the European Union for sponsoring this study through its Seventh Framework Programme FP7/2007-2011 under Grant Agreement n° 290693 FOODSECURE and co-implemented by the Center for Development Research (ZEF), University of Bonn.

My doctoral studies would not have been possible without the support of many people. I am extremely thankful to Prof. Dr. Joachim von Braun for his advice and support during the course of my studies. His encouragements have helped me explore this recent and yet inspiring area of research. I have greatly benefited from his insightful comments and suggestions during the preparation of the thesis. I greatly appreciate my tutor, Dr. Nicolas Gerber, for having been a constant help not only academically but also socially. The thesis would not have the present shape had it not been for his thorough reviews and numerous consultations. I am thankful to Dr. Julia Anna Matz for her inputs for the improvement of Chapter 3. I thank my second supervisor Prof. Dr. Jan Börner for his feedback during one of my presentations and an individual consultation. I also thank Prof. Dr. Ernst Berg and Prof. Dr. Christian Borgemeister for their willingness to serve on the committee for the evaluation of the thesis.

I am grateful for all the academic and administrative staff at ZEF, and especially Dr. Gunther Manske and Mrs. Maike Reta-Amin for all the support they have provided me with. I extend my appreciations to my colleagues at ZEF, especially my batch mates, for the academic as well as social interactions which have made the journey of my studies enjoyable. I specially thank my colleagues Kyere Vincent Nartey for helping me generate the map of the study sites, and Till Ludwig for translating the abstract of my thesis into German. Staying away from family is challenging, but having the company of Gebre-Libanos G/M, Kasahun Aberra, Million Getnet, Tigabu Degu and many other friends has made it bearable. Thank you guys!

I want to specially thank Dr. Alemayehu Seyoum Taffesse for serving as my local advisor and sharing his expertise on the research, providing me with the survey instrument that he and his colleagues developed, and for the logistical support that facilitated my field work. I also thank IFPRI Addis Ababa for providing me with an office space during my stay for the field research. I am thankful to my former colleagues at IFPRI-Addis, and especially Dr. Elias Zerfu for their advice and support during my field research. I thank my field research assistants for conducting the survey diligently, and my friend, Berihun Mekonnen, for helping me organize the survey team and follow-up of the survey administration. I also thank the Heads of office of the Woreda Bureau of Agriculture in each study site for their support during the survey. My special thanks go to the survey respondents for sacrificing their precious time and enduring long hours of interview to sharing with us their beliefs, aspirations and achievements. I also thank them for their hospitality to the survey team. I thank the SASAKAWA Global 2000 for making their survey data available to me.

Next to the Grace of God, the moral support and prayers of my grandfather Melake-Tsehay Haile Mekonnen and his children: Asresu, Sophi, Tiru, Getch, Sammy, the two Ephraims, and Kubi have kept me going. I am fortunate to having you guys, for being a source of inspiration for me to aspiring higher and taking 'risky' decisions in my life. Thank you all! My special thanks also go to my in-laws, especially Ato Deribe Bekele and W/ro Workaferahu Hailu for being there for my kids when I was away conducting my studies. My better half, Rahel, I hope you still believe in the cause and agree that it was worth the sacrifice. Thank you for trying to filling the gap my absence would have created, especially on the lives of our children - Arsema and Caleb. I am hopeful that, as the kids grow old, they would understand the reason why I was constantly away. I dedicate this achievement to my two little angels, Arsema and Caleb, with Love!

1. NTRODUCTION

1.1. Statement of the problem

Despite progress, poverty persists across the developing world. The latest estimates put the share of the world population living under $1.90 or less per-day[1] at about 12.8 percent (or around 900 million people in 2012, and a projected 700 million in 2015) (World Bank Group, 2016). The same report puts 1.6 billion people as multidimensionally[2] poor in 2015. Until recently, the literature in development economics on poverty focused on income and consumption and to a lesser extent on social indicators such as life expectancy, under-five mortality, inadequate access to services including education, health, water and sanitation, etc. It is nowhere more evident than the World Bank's influential publication with special issues on poverty, *the world development report*, of various years (1978, 1980, 1990, 2000/01) that the concept is analysed almost exclusively along these dimensions, which are also referred to as "external" constraints.

Along this line of thought, recent studies aimed at understanding the causes of poverty persistence find that poor households frequently underinvest even when returns are high (Banerjee and Duflo, 2011). Such findings have motivated researchers to employ multidisciplinary tools and concepts for a better understanding of the situation of the poor. Consequently, some studies find evidence that poverty actually depletes mental resources or impedes cognitive capacity (e.g. Mani, et al., 2013) and this might lead people to making decisions based more heavily on "automatic thinking (which considers what automatically comes to mind and is effortless, associative and intuitive) rather than deliberative thinking (which considers a broad set of relevant factors and is effortful, based on reasoning, and reflective)" (Kahneman, 2003 and World Bank, 2015a: p.6). This in turn may result in sub-optimal outcomes, such as poor material well-being. Relatedly, other studies suggest that poverty depletes the ability to self-control on unwanted thoughts such as unwise spending, or activities that are harmful to health, or behaviors in general that can perpetuate a disadvantaged state (Vohs, 2013). These imply that poverty or a deficit in material resources cannot be understood in isolation to the context in which decisions are made (World Bank, 2015a).

An alternative, but closely linked, explanation to the (under)investment behavior of the poor is related to the lack of aspirations or aspirations failure (Appadurai, 2004 and Ray, 2006). According to this theory, poverty limits the people's 'capacity' to aspire (Appadurai, 2004) by creating mental models that uniquely diminish the significance of some features of the environment while magnifying others (Bernard et al., 2008). Ray (2006) extends this view and argues that poverty stifles dreams and this may result in a self-sustaining trap of poverty and the failure of aspirations. Yet, whether aspirations failure is a cause or a consequence of poverty is inconclusive. Dalton et al.

[1] A revised international poverty line based on 2011 prices

[2] According to World Bank Group (2016), multidimensional poverty index (MPI) is used to measure the incidence and breadth of those who are deprived in multiple dimensions including health, education, and standard of living. These dimensions are measured using 10 indicators: child mortality and nutrition (for health); years of schooling and school attendance (for education); and cooking fuel, toilet, water, electricity, floor, and assets (for living standards). Each dimension and each indicator within a dimension is equally weighted. For each of the indicators a deprivation cutoff is set.

(2014), for example, theoretically show that while both the rich and the poor may share the same preferences and also behavioral bias in setting aspirations, poverty exacerbates the effects of this behavioral bias leading to behavioral poverty traps and the failure of aspirations, ultimately affecting their effort choices as a result. This implies that internally constrained people may not only fail to create opportunities for themselves, but also fail to use them when they are available (Bandura, 2009) albeit with some cost, for example, insurance, credit, information (Bernard et al., 2008), innovations and innovation products, etc.

Further, Appadurai (2004) and Ray (2006) postulate that aspirations are formed socially, through comparisons and by learning from 'relevant others', or what Ray (2006) refers to as the *aspirations window* – an individual's cognitive world from which the individual draws their aspirations. Yet, a related literature also suggests that social interactions generate knowledge externalities, such as the adoption of agricultural innovations (e.g. Conley and Udry, 2010; Bandiera and Rasul, 2006; and Foster and Rosenzweg, 1995). With the exception of a few studies (such as Thomson et al., 2015; Bernard et al., 2014, 2012; Kosec et al., 2012; Macours, and Vakis, 2009), empirical test of the aspirations failure theory, particularly in the context of agriculture, is largely lacking. More specifically, there is little empirical evidence examining the formation of aspirations and the channels in which aspirations might be related to well-being outcomes and their determinants including risk behavior and the adoption of agricultural innovations. This study contributes to the literature by examining the following research questions.

1.2. Research questions

In view of the aforementioned problem statement and the research gaps in the literature, the thesis attempts to answer the following research questions:

1. How might social interactions shape aspirations?
2. How do social networks affect the adoption of agricultural innovations and farm productivity?
3. How might aspirations affect risk and time preferences?
4. How do aspirations affect the adoption of agricultural innovations?
5. How do aspirations affect well-being outcomes such as income, food security, and subjective well-being?

1.3. Overview of the data and methodology

The data comes from a household survey carried out between January and March 2014 in Ethiopia. The survey builds upon an existing sample of agricultural households surveyed in 2006 and again in 2010. The sampling method is fully described in chapter two. But in general, the study is based on 379 farm households who reside in three study sites which are shown in Figure 1.1. Each study site comprises of two neighbouring districts with similar characteristics including the crops grown. The study sites are: Bakko-Sibu Siree, Adaa- Lume, and Hettosa-Tiyyo. The latest survey differs from the previous two waves for it has collected information on

aspirations and social networks. Both the household head and the spouse were separately interviewed about their aspirations and future expectations using four indicators including: income, wealth, social status and children's education. Based on these four indicators, an aggregate aspirations index and aspirations-gap are calculated using the formulas described in chapter 2. Additional data on aspirations was also collected using qualitative interviews. The data on social networks was collected based on two techniques: "self-reported networks" and "random matching within sample." Details on social networks are given in chapter 3. Further, the survey collected other individual and household level socio-economic information including on production and inputs, assets, income, consumption expenditure, food security and other indicators of well-being outcomes. Econometric techniques are the main method of analysis. The thesis, however, relies mainly on the 2014 data as the variables of interest (i.e. aspirations and social networks) are missing in the preceding surveys. The data from the previous two waves are used to show trends on key outcome indicators and some of these lagged values are also used as identifying instruments.

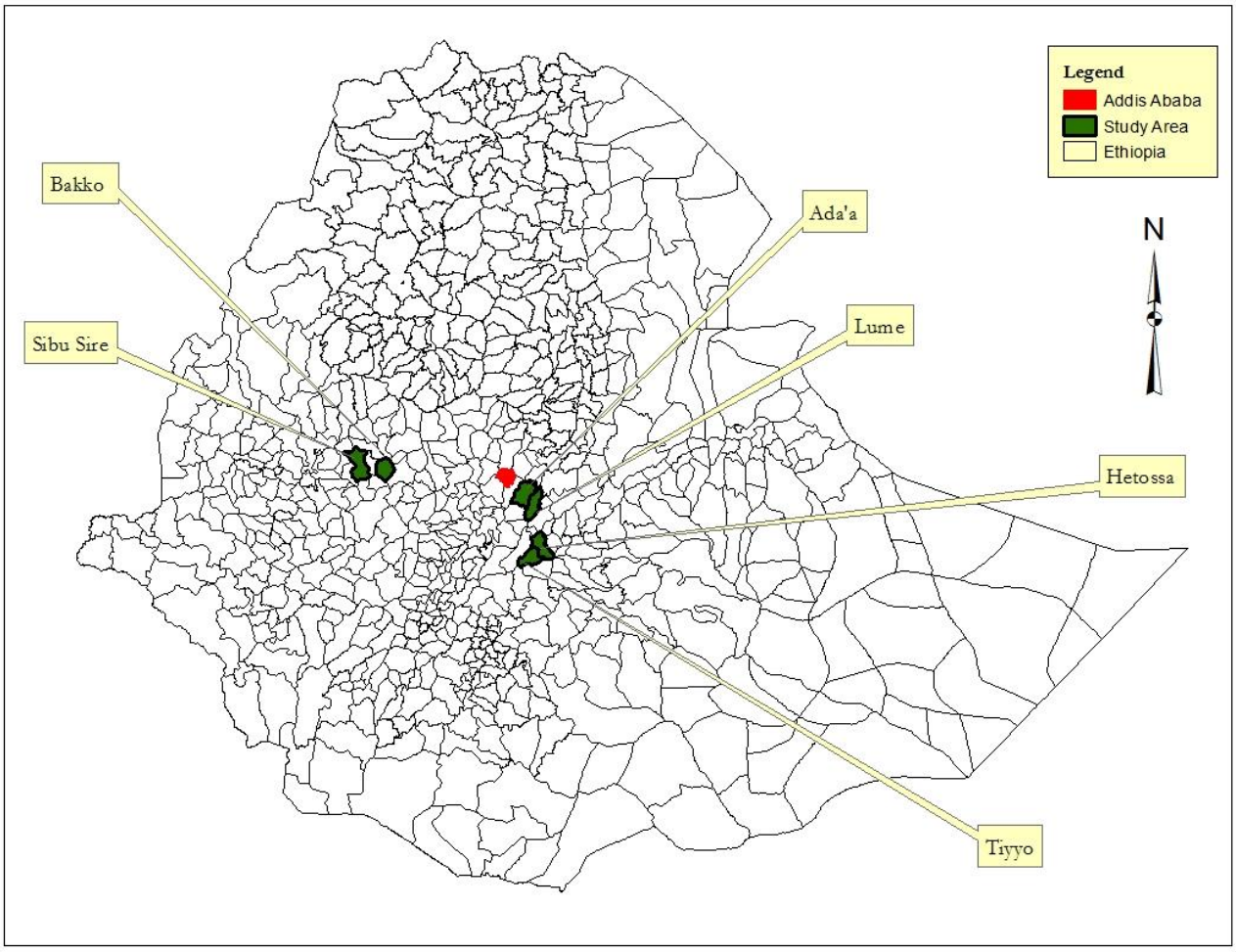


Figure 1.1. Location of the study sites and the capital of Ethiopia.[3]

[3] The map was generated using ArcGIS software based on GIS data accessed, on march 03 2016, from http://www.diva-gis.org/gdata

1.4. The conceptual framework

Figure 1.2 schematically presents the overall conceptual framework that guides the thesis. According to this framework, which is conceptualized based on the existing literature, policies and institutions determine the formation of material and human capital, and other well-being outcomes. The nature of distribution of these outcomes in the society jointly with cultural factors and social interactions may give rise to either aspirations or aspirations failures. According to the literature, while people from all walks of life may exhibit some form of behavioral bias towards their own potential, poverty can exacerbate the effects of this behavioral bias and this may lead to behavioral poverty traps. Consequently, people who are in behavioral poverty traps may fail not only to exploit their potential or create opportunities for themselves, but also to make use of available opportunities. Thus, in the absence of policy interventions targeting those behavioral biases, the poor may remain in a self-sustaining trap of poverty and the lack of proactive behavior. This shows a two-way link between aspirations and well-being outcomes.

Aspirations may affect well-being outcomes through direct and indirect channels. First, aspirations are assumed targets or reference points - they are motivators. Hence they may directly influence forward-looking behavior such as investment in agricultural innovations. On the other hand, since getting return from such investments requires patience and risk-taking, aspirations can enhance such behavior and motivate people to minimize time discounting and risk aversion. In this context, finding ways of raising the aspirations of the poor may be of paramount importance for enhanced aspirations may improve not only forward-looking behavior such as the adoption of agricultural innovations but also the effectiveness of other policies such as those promoting agricultural innovations.

Further, the literature on social networks suggests that economic agents embody various knowledge and information and hence interactions among them can generate knowledge externalities. Social networks are the channels for such interactions and social learning; and these channels provide the linkage with the formation of aspirations and wealth as well as with risk and innovation behavior.

In summary, the framework highlights the channels in which aspirations might be linked to various outcomes and behavior. It also shows the potential interventions that may break poverty traps, either by simply raising the aspirations of the poor or jointly with mechanisms that raise the wealth of individuals and/or by reducing the cost of effort (e.g. the cost of innovations) the poor face. In the light of this framework, the thesis answers the research questions identified from the research gap in the literature.

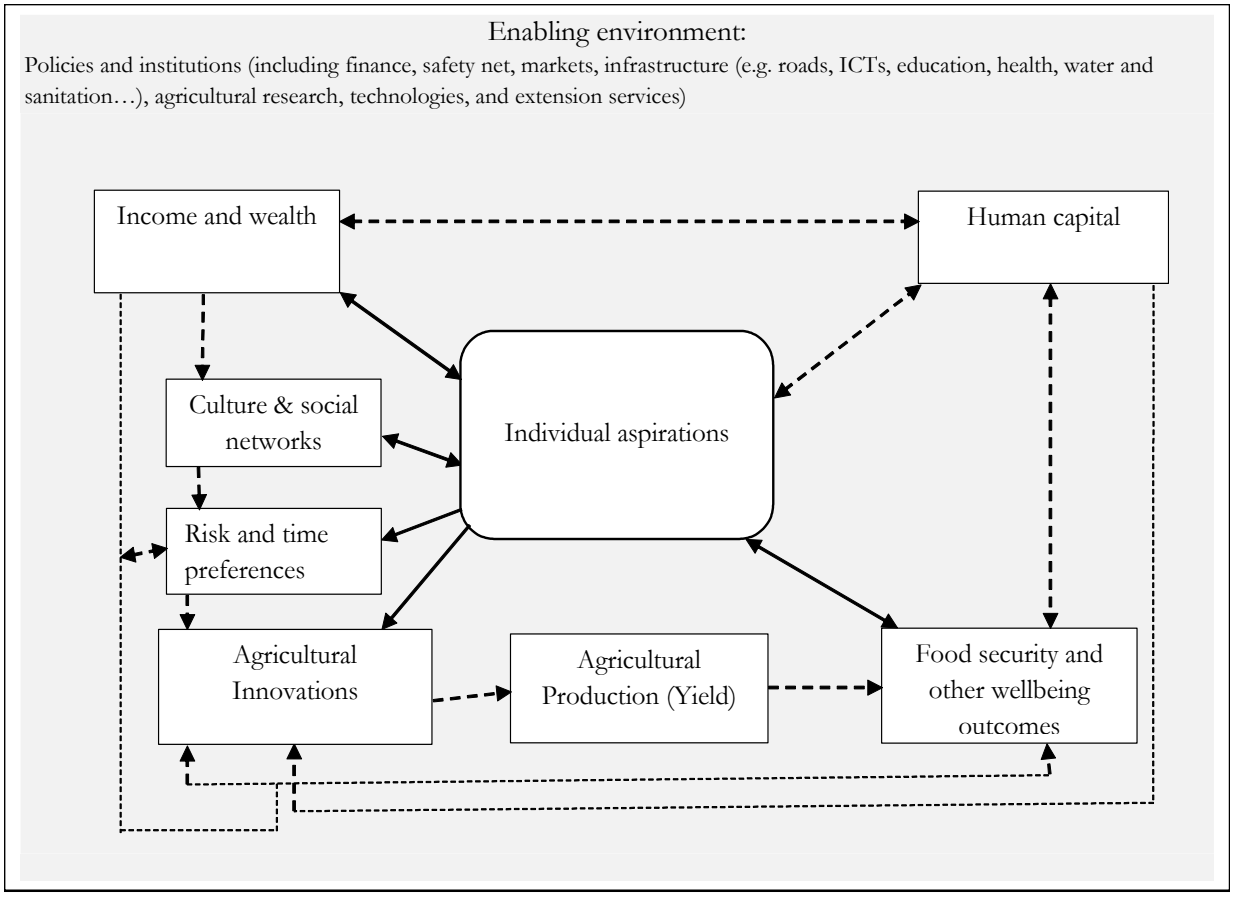


Figure 1.2. The conceptual framework
Source: Own conceptualization based on the reviewed literature

1.5. Organization of the thesis

The remainder of the thesis is organized in five chapters. In the next Chapter we empirically examine the social drivers of aspirations in rural Ethiopia. Since the ultimate goal of the thesis is to examine the impact pathways from aspirations to well-being, we proceed, in the same Chapter, by investigating how aspirations might be linked to time and risk preferences, two widely established determinants of well-being through their effect on effort choices such as the adoption of agricultural innovations. Yet knowledge externalities are also generated from social interactions. Hence, we examine in Chapter 3 if that is actually the case by studying the effect of social networks on the adoption of row-planting (a recent innovation in Agriculture in Ethiopia) and farm productivity. We extend our study on the determinants of agricultural innovations in Chapter 4, with a special focus on the effect of aspirations. In doing so, we relate aspirations with the adoption of various agricultural technologies and improved practices. Since aspirations also directly affect well-being, we examine, in Chapter 5, the links between aspirations and well-being outcomes including income and expenditure, various dimensions of food security, and subjective well-being. We present summary of the main findings and conclusions of the thesis in the last Chapter where we also highlight the limitations of the study.

2. SOCIAL INTERACTIONS, ASPIRATIONS AND TIME AND RISK PREFERENCES IN RURAL ETHIOPIA

Abstract

Despite increased development efforts, the persistence of poverty in some parts of the society across the globe require an increased use of multidisciplinary tools and concepts for better understanding of the problem. One of the recent conceptual tools that has gained increased attention include the aspirations-failure framework linking the situation of the poor and their (under)investment behavior to low aspirations (or aspirations failure). Based on this conceptual framework, this Chapter empirically examines the effects of social interactions on aspirations (with respect to income, wealth, social status and education), and of aspirations on time and risk preferences in rural Ethiopia. Findings in this study are in line with the theory which suggests that aspirations are socially determined through observations as well as social interactions. Further, results indicate that social network size is an important determinant of aspirations, attesting to the importance of widening the *aspirations window*. The study also reveals evidence that aspirations-gap (AG, i.e. the difference between current and aspired status) affects risk behavior non-linearly. Across gender, results show that the effects of social interactions on aspirations and of aspirations on risk preferences are larger for females. Findings in this Chapter imply that policies aimed at raising the aspirations of the poor may benefit from social interactions, and hence any such efforts may use as well as invest on social networks and reap the corresponding multiplier effects. Further, strategies that empower women and particularly that help widen their aspirations windows may earn the highest impact for wider aspirations windows may increase their aspirations-gap which in turn may relax their risk aversion.

Key words: Social interactions, aspirations, risk preferences, Ethiopia

2.1. Introduction

Despite progress, poverty persists across the developing world. A synthesis of several studies across continents finds that poor households frequently underinvest even when returns are high (Banerjee and Duflo, 2011). This puzzle has inspired the research community and other actors to increasingly explore the use of multidisciplinary tools and better understand poverty and other development challenges. For example, the World Bank's flagship publication, *world development report 2015,* entitled *Mind, Society, and Behavior* is a recent evidence of attempts broadly exploring the issue using multidisciplinary approach. Earlier studies in social psychology such as Bandura (1977) and Bandura et al. (1977) showed how perceived self-efficacy and behavioral changes might be related and how might behavior be altered by changing the level and strength of self-efficacy. These and related literature in other social sciences lend conceptual tools for the study of poverty and well-being outcomes.

One of the concepts that has gained recent attention in development economics is the aspirations failure framework, following Appadurai (2004) and Ray (2006), which links the situation of the poor and their (under)

investment behavior to low aspirations (or aspirations failure).[4] According to Appadurai (2004), Dalton et al. (2014) and Ray (2006), "internal" constraints such as the lack of aspirations and other psychological factors could reinforce "external" constraints (or material deprivation) and this may lead to a self-sustaining trap of poverty and the lack of proactive behavior. Further, some empirical studies find that internal factors such as aspirations and risk behavior could pass on intergenerationally (De Paola, 2013; Dercon and Singh, 2012). These imply that finding ways of enhancing the aspirations of the poor could be a powerful tool to break cyclical poverty traps and other development challenges.

Aspirations are assumed targets or reference points (Payne et al, 1980). Thus, they are motivators that may directly influence investment or forward-looking behavior. Yet, Genicot and Ray (2014) argue that aspirations encourage investment to the extent that they are moderately above an individual's standard of living, that is "large enough to incentivise but not so large as to induce frustration" (p.1). Put differently, the difference between the aspired and achieved outcomes- also referred to as the *aspirations-gap*– affects future oriented behavior (Ray, 2006). So, when this gap is either too narrow or too wide may lead to aspirations failure or exit, for the former the reward is considered too small for the effort; and for the latter the relative gap will remain large regardless of the amount of effort put in (Ray, 2006).

Aspirations are socially determined, through observations and comparison of own outcomes with that of others' in the reference group (Appadurai, 2004; Ray, 2006), and by the existing income distribution (Genicot and Ray, 2014; Stark, 2006). Relatedly, Akerlof's (1997) discussion on social distance and interactions highlights the importance of one's initial condition for social decisions that affect behavior and eventually economic decisions.

In this context, we empirically examine the importance of social interactions on aspirations. Beside the direct motivation effects, the other hypothesised channels through which aspirations may affect forward-looking behavior is through their effects on minimising time discounting and risk aversion – two widely identified drivers of poverty and well-being outcomes. We empirically test these hypotheses. The remainder of this Chapter is organized as follows. The next section presents the background and review of the related literature followed by section 2.3 which presents the data and descriptive statistics. Section 2.4 presents the empirical strategy. Results are discussed in section 2.5, and section 2.6 concludes the Chapter.

2.2. Background and literature review

Individual behavior is influenced by the social environment, also referred to as 'culture' – a set of shared beliefs, symbols and customs (Goodenough, 1999). According to Goodenough (1999), culture consists of cumulated knowledge and experience involving participant observations and interactions. These may affect behavior, for example by expanding the participant's 'capacity to aspire' since the "ideas of the future, as much as of those

[4] Citing the dictionary definition of aspiration as "a desire or ambition to achieve something", Bernard et al (2011) note that simple wishes are different from aspirations for the later implicitly requires to exert some effort to realize the desired aim or target.

about the past, are embedded and nurtured" in culture (Appadurai, 2004, p.59). In other words, the social environment shapes behavior partly because people compare their outcomes and achievements not only to their own past level, but also the average achievements of relevant others – in what Ray (2006) referred to as the *aspirations window* – "an individual's cognitive world, her zone of 'similar', 'attainable' individuals (in terms of their life styles, their social and political norms, and their economic well-being), and from which the individual draws her aspirations"(p. 2). Consequently, individuals react by investing in own self-improvement (Genicot & Ray, 2014). Yet, these investments are subject to risk - a situation where outcomes are not known with certainty due to: "the inability to control and/or measure precisely some causal factors of events, the limited ability to process information, and the costly nature of obtaining and processing information*"* (Chavas, 2004, pp. 5-8).

Due to the presence of risk and uncertainty, people tend to adapt to their personal histories and/or tend to conform with others for the behavior of others conveys information and also because there could be a direct benefit from aligning with others regardless of whether they are making best decisions (Easley and Kleinberg, 2010). In this regard, Ray (2006) discusses three pathways in which group action may influence individual behavior, by acting as: "internal conveyors of information (e.g. motivation drawn from education experience of neighbors), external conveyors of information (e.g. as lobbying force), and coordination devices (e.g. savings group in which peers' savings behavior may motivate individuals to save)" (pp.10-11). Relatedly, Thaler and Sunstain (2009) summarize social influences into three groups: information, peer pressure, and *priming- "*mysterious workings of the automatic system of the brain…and uses… certain information that immediately comes to mind" (p. 69). Thus, according to Thaler and Sunstain, the power of social influences can help promote policy using *nudges*[5]. A typical example in this regard is the Grameen Bank model, also referred to as social business, which combines social mobilization and banking services.[6] According to Esty (2013) and Rouf (2011), this group based financial service empowers women, builds their confidence and motivation through its education program. For example, prior to taking out loans, recipients are required to make 16 Decisions[8] that affect their lives. They are also required to hold regular peer group discussions so that they would build supportive friendships and share information and tips that proved key to the success of their business ventures (Esty, 2013). To sum up this section, the theoretical literature suggests that social interactions affect individual behavior, including aspirations. Next, we briefly review some empirical literature on the effects of social interactions on aspirations and of aspirations on time and risk preferences.

[5] Thaler and Sunstein (2009), for example, offer four different strategies that might influence behavioral change. These include putting restrictions, offering incentives, persuasion or provision of information, and nudging (or making it easy for people to accomplish the desired choice).

[6] According to the information available on the Grameen Bank website, the Bank tries to bring about socio-economic transformation through provision of collateral-free, group based credit to the poorest of the poor in rural Bangladesh. Its operating principle is based on mutual trust, accountability, participation and creativity. The issues included in the 16 Decisions range from socio-economic to environmental development that affect the lives of the poor. http://www.grameen.com/index.php?option=com_content&task=view&id=22&Itemid=109&limit=1&limitstart=15 Accessed on April 30, 2016

2.2.1. Social networks and aspirations

The existing literature argues that the existence of various reference groups and/or networks along with the availability of information and differential economic opportunities may trigger feelings of relative deprivation, envy, or increased self-efficacy and aspirations. In this context, in India, Beaman et al. (2012) find that, even in the absence of change in labor market opportunities, exposure to female leaders in local government raised both the aspirations and educational attainment of girls. The role model effect was argued to be the most important channel in changing aspirations, which Macours and Vakis (2009) also find in poor rural areas in Nicaragua. Using a short term training and cash transfer program aimed at increasing households' investments, Macours and Vakis (2009) find a positive impact of social interactions on aspirations. The authors find stronger results particularly where program beneficiaries lived closer to group leaders who were also recipients. Similarly, using a randomized control that varies the intensity of treatment, i.e. number of people invited to watch inspirational videos, by village, Bernard et al. (2014) show that such simple interventions could help change people's behavior such as aspirations. On the other hand, based on a survey data collected from rural Nepali women, Thompson et al (2015) find evidence that peers' readily observable assets drive one's own wealth aspirations.

Empirical studies examining the social aspects of aspirations formation are quite few. The studies reviewed here, with the exception of Thompson et al (2015), rely on randomized experiments that exogenously vary group composition and/or partial interventions that directly affect only some peers within a group. These allowed the studies to account for the common problems of identification which may arise due to the endogenous formation of networks and/or simultaneity bias (Manski, 1993). The commonality of these studies is that they show the power of social interactions in influencing individual behavior such as aspirations. The underlying reason or pathways for behavioral change might actually lie along the interactions between aspirations and risk preferences, which is reviewed next.

2.2.2. Aspirations and risk preferences

Aspirations and risk preferences are related for the latter depend on the values of possible outcomes relative to the levels of aspired ones (March, 1988). As a consequence, some risk averse behavior may result from the human tendency to focus on targets and from the adaptation of those targets to experience rather than from a fixed trait of risk aversion (March, 1988). Further, both aspirations and risk preferences are influenced by the behavior of others in the reference group (Knudsen, 2008; March, 1988). For example, in a population of decision makers with aspirations that adapt to the median wealth, March (1988) argues, success relative to others in the population produces a preference for relatively low risk alternatives, while failure relative to others leads to a preference for risky alternatives. This, according to March, is driven by a preference for relative stability in wealth. Knudsen (2008) extends the work by including the case of multiple reference groups and shows that social interaction and relative comparisons are dominant drivers of performance and that the presence of various reference groups provides more important bases for variable risk strategies than the decision maker's own situation.

By defining the aspiration level as an assumed target or reference point, Payne et al (1981) extend earlier work by Payne et al (1980) that tested the importance of the aspiration level in the analysis of risky choice behavior. The studies relate pairs of gambles to an assumed target or reference point. The authors vary target levels in a series of experiments while holding gamble outcomes constant. They find evidence of aspirations effect on risky choice behavior – that people tend to choose the riskier alternative if the outcomes are below some target level (or involve losses) than they are if the outcomes are above some target or aspiration level (or involve gains). These findings are in line with Tversky and Kahneman's (1992) finding of risk aversion for gains and risk seeking for loses of high probability; and, risk seeking for gains and risk aversion for loses of low probability. This tendency of decision making also referred to as "loss aversion" may arise for losses heart much more than gains make one happy (Kahneman and Tversky, 1984).

One of the recent studies that use lotteries or gambling games to measure individual risk attitudes include Yesuf and Bluffstone (2009). The authors examine the attitudes of Ethiopian smallholder farmers toward risk when faced with new agricultural technologies. They find that households are more sensitive to potential losses than they are to gains. Based on experimental evidence, they find that households that stand to lose as well as gain from adopting a new technology are significantly more risk averse than those that face potential gains only.

Risk preferences, on the other hand, may not only affect outcomes of a person and their household, but also pass on intergenerationally. For example, using data from a sample of Italian students, De Paola (2013) tests and finds evidence of intergenerational transfer of risk behavior. The study finds that students whose fathers were employed in the public sector are more risk averse, while students whose fathers were entrepreneurs have a higher propensity to take risks. Relatedly, using panel data from a cohort study of 12,000 selected children (ages 8, 12 and 15 year) and their parents across Ethiopia, India, Peru, and Vietnam, Dercon and Singh (2012) test if there is evidence of transmission of aspirations from parents to children. Controlling for other family characteristics, the authors find a positive and strongly significant link between parental and child aspirations in terms of aspirations for education.

In summary, the existing literature suggests that aspirations are formed not only from own outcomes (e.g. education, wealth, etc.), the production of which are already subject to risk, but also the outcomes of the reference groups or "networks." This needs empirical test. On the other hand, aspirations are motivators which may directly affect forward-looking behavior. The other channels that aspirations are hypothesised to affect forward-looking behavior is through their effect on risk and time preferences. Hence, in this Chapter, we look at the effect of social interactions on aspirations, and of aspirations on risk and time preferences.

2.3. Data

2.3.1. Sampling and measurement issues

The data comes from a household survey carried out between January and March 2014 in Ethiopia. The survey builds upon an existing sample of agricultural households surveyed in 2006 and again in 2010[7] in Oromia region under an NGO project that promoted agricultural innovations and which ended in 2010. The original survey used a mix of purposive and random sampling procedures to select 390 households from three study sites (Aredo, et al. 2008). The primary sampling unit consisted of a pair of neighboring districts or *woredas* which had been chosen based on the density of cultivation of the major crop and on the presence of active farmers' cooperatives. At the second stage, *kebeles* (sub-districts) which had active farmers' cooperatives were selected. Using the number of participating households within a cooperative as a sampling frame, households were randomly selected. The total sample size at each research site is summarized in Table 2.1.

Table 2.1. Geographic distribution of the sample

	Bakko- Siree site		**Lume-Adaa site**		**Hettosa-Tiyyo site**		**Sample size**
District	Bakko	Sibu Siree	Lume	Adaa	Hettosa	Tiyyo	Total
Sample size at baseline (2006/07)	65	65	65	65	65	65	390
Sample size (2014)	64	63	63	64	62	63	379

In the latest survey, 11 out of the total of 390 households from the baseline dropped out of the survey for various reasons, including death, relocation to another area and unavailability for the survey interview. Further, due to incomplete data, four more households were excluded from the analysis. Hence, this study is based on 375 households. Nevertheless, when compared against the full sample, the households that dropped out of the analysis did not show any statistically significant baseline difference with regards to key indicators such as income, wealth, and landholdings. This implies that sample attrition is not systematic. Further, since the latest survey included individual level data (i.e. for the household head and the spouse separately), the sample size for individual level analysis is 675. The sample size at individual level is less than twice the number of households. This is because some households are single headed and in others only one of the two spouses were available for interview.

2.3.1.1. Defining social networks

Earlier studies on the social drivers of individual behavior, for example in terms of technology adoption, defined reference groups based on membership to a village, clan or a group defined by other social and cultural boundaries (e.g. Foster and Rosenzweig, 1995; Munshi, 2004; and Isham, 2002). One of the underlying assumptions is that the outcomes and behavior of all individuals that form the group affects the member's behavior. Yet, this may not be necessarily the case for individuals may look up and draw inspiration only from those who are doing better or from others who are outside the defined network. However, the advantage of, for example, defining the village as a reference group is that it may not only ensure the exogeneity of networks, but

[7] The analysis in this Chapter relies mainly on the 2014 survey for the main variables of interest (i.e. aspirations, networks, risk and time preferences) are missing in the preceding surveys. Yet, to ensure exogeneity, we make use of lagged values of some explanatory variables.

also capture the influence of multiple reference groups that may exist in the village. On the other hand, more recent studies rely on individual level links reported by the respondent either in or out of a sample (e.g. Maertens and Barrett, 2013; Conley and Udry, 2010). While these approaches may allow respondents to name people in their cognitive window, whom they closely interact with and compare themselves with, the technique may suffer from a truncation bias especially if respondents are allowed to name only a certain number of links while in fact their true networks are much wider (Maertens and Barrett, 2013).

In this study we employ both approaches, taking the village (or *kebele*) as a reference group, as well as individual links reported by the respondent. For the latter, we employ a 'random matching within sample' technique where each respondent is matched with six randomly drawn individuals from the sample. Then, conditional on knowing the match, we construct networks by eliciting the details of the relationships between the individual and the match. This technique could help minimize the endogeneity of networks. This is because the matches listed to the respondent are exogenously determined (by the researcher). Out of the 6 people listed to the respondent, the number of matches known to the respondent ranged from 1 to 6 people, with the average of 4.3 people. Across gender, female respondents knew 4.1 people and males knew 4.5 people, on average.

2.3.1.2. Measuring aspirations

Individuals may set different goals in life, which makes aspirations multidimensional. Aspirations are also dynamic that they tend to change in light of new experiences, choices and information (Leavy and Smith, 2010). Further, since aspirations are attitudinal in nature, measurement errors could easily arise due to "anchoring, wording and scale dependence; respondent role playing and instability over time or over respondents' moods" (Bernard and Taffesse, 2014. p.190). Against this backdrop, however, what is suggested in the literature is that useful information could still be collected as long as extra care is taken during the design and implementation of surveys.

For this study, we employ the survey instrument developed and tested for validity and reliability by Bernard and Taffesse (2014). To capture aspirations in four dimensions, the survey asks individuals a series of five questions regarding their income, wealth, social status and children's education. Specifically, the questions ask:

(1) "What is the level of […] you have at present?"

(2) "What is the level of […] that you would like to achieve?"

(3) "What is the level of […] that you think you will reach within ten years?"

(4) "What is the maximum level of […] that a person can have in your village?"

(5) What is the minimum level of […] that a person can have in your village?"[8]

[8] Wealth (or current value of assets) and income (annual income from agriculture and non-agricultural activities) were asked in terms of Ethiopian Birr (The official exchange rate during the time of the survey was 1 USD= 19 ETB); Children's education in terms of levels/grades of education; and, social status in terms of the percentage of people in that village that ask for the individual's advice on some important decisions.

Questions regarding own current level, village maximum and village minimum are intended to serve as a benchmark against which respondents would state their aspired level. The question on the expected level is intended to guide respondents in differentiating their aspirations from their expectations. To ensure that respondents understood the questions and did not state their simple wishes when we asked their aspirations[9], special care was applied during interviews, including by probing and checking for consistency across responses. For example, after further clarification of the concept and definitions, respondents were allowed to change their responses if they thought that they had given "incorrect" responses.

In addition, since each dimension of aspirations may mean different things for different people (Leavy and Smith, 2010), the weight or relative importance respondents place on each of the four dimensions was captured as explained next. First, respondents were given 20 beans and a piece of paper that pictured four squares. Each square is labelled with one of the four dimensions of aspirations (i.e. income, wealth, social status or children's education). Then, respondents were asked to distribute all the 20 beans in the four squares according to their own assessment of the dimension's significance for them. The instructions were clear. For example, it was explained that no bean in a square means the respondent does not attach any importance to that particular indicator and, many beans in a square means the respondent attaches a significant importance to it. In what follows, we explain how the subjective weights given by the respondents are used in the calculation of an aggregate aspirations index.

As noted earlier, individuals aspire to achieve different things depending on their experiences and information set that they have. Hence, relying on any single indicator may not suffice to measure aspirations. Yet, these four indicators are believed to be strongly correlated to each other and to many targets a person might want to achieve in their life. In this context, the aggregate index is believed to capture a broad array of life targets and serve as a strong proxy for measuring aspirations. Consequently, we calculate an aggregate index following Beaman et al.(2012), Bernard and Taffesse (2014) and Kosec et al(2012). The index is constructed by first normalising[10] each dimension (i.e. by removing the average level for individuals in the same district, and then dividing this difference by the standard deviation for individuals in the same district) and multiplying the result by the weight each individual gives to each of the four indicators. Summing across the weighted average of the four normalized outcomes provides an aggregate aspirations index.

The calculation of the aggregate aspirations index (A_i) can be represented as:

$$A_i = \sum_{n=1}^{4} \left(\frac{a_n^i - \mu_n^d}{\sigma_n^d} \right) . w_n^i \qquad (1)$$

Where:

[9] Simple wishes are different from aspirations for the latter entails action to achieving them

[10] As noted before, attitudinal measures such as aspirations are likely to be measured with errors, normalization would help to smooth out errors at individual level. Further, normalization also makes individual indicators unit free, a prerequisite for aggregation

a_n^i is the aspired outcome of individual i on dimension n (income, assets, education, or social status).

μ_n^d is the average aspired outcome in district d for outcome n.

σ_n^d is the standard deviation of aspired outcomes in district d for outcome n.

w_n^i is the weight individual i places on dimension n.

The aspirations-gap

The aspirations-gap is the difference between the aspired outcome and current level, for each of the four dimensions. The multidimensional aspirations-gap index (AG_i) is calculated by dividing the aspirations-gap with the aspired outcome, weighted by dimension and summed over the four dimensions. This can be represented in the following equation:

$$AG_i = \sum_{n=1}^{4} \left(\frac{a_n^i - y_n^i}{a_n^i}\right) . w_n^i \qquad (2)$$

Where:

a_n^i and w_n^i are as defined before.

y_n^i is what is presently possessed by individual i for outcome n

Qualitative approach to measuring aspirations

To supplement the quantitative measurements of aspirations discussed earlier, our survey included two simple and open ended questions which were used in (Ibrahim, 2011). These questions ask: (1) "What are the three most important things that you wished to achieve in life but couldn't?" (2) "Why couldn't you achieve them?" These questions are intended to capture the "aspired but unfulfilled capabilities" (Ibrahim, 2011). Further, as argued by the author, this approach not only allows the respondents to list which aspirations they had (or have), but it also helps explore why they have failed to achieve these aspirations. Summary results of the interviews are discussed in the descriptive statistics section.

2.3.1.3. Measuring risk and time preferences

Since Binswanger (1980), several studies have conducted experiments or used lotteries to measure individual risk attitudes. Following suit, we adopt the same survey instrument as Bernard et al (2014) that followed Binswanger (1980). Two sets of questions are used to elicit risk preferences, based on hypothetical decisions. The questions ask respondents to choose what they would prefer from each of the two choice sets: (a) five lottery choices with payouts determined by coin toss, and (b) risk choices about the selling price of a bag of maize. In both cases, payouts are ordered from most to least risk averse (see Table 2.8).

Time preferences or measures of impatience are also included in the survey. On a hypothetical state, respondents were asked to choose between a gift of "100 ETB today or 125 ETB in one month," then, "100 ETB today or 150 ETB in one month." The two offers were repeated by changing the waiting time to one month and two months, respectively. Now, referring to the first choice, if people are very patient, they should choose to wait for 125 ETB in one month, and the variable takes on a value of 0. Otherwise, the variable takes on a value of 1 if

people are impatient. The same logic applies to the remaining choices. Discount rates are then calculated by summing over the four outcomes. Hence the time preference variable is increasing in impatience and ranges from 0 to 4.

2.3.2. Descriptive statistics

2.3.2.1. Aspirations and Aspirations-gap

Table 2.2 presents the level of aspirations by gender of the respondent along with corresponding mean comparison test. In general, males reveal higher level of aspirations in all dimensions and the mean differences are statistically significant.

Table 2.2. Aspirations level the respondent would like to achieve

	Male (N=329)		Female(N=346)		diff = Mean(Males') - Mean(Females')
	Mean	Std. Dev.	Mean	Std. Dev.	Pvalue
Income	202,325	277,956	125,833	210,791	0.0001
Assets	495,930	731,861	240,052	458,001	0.0000
Social status	94	15	87	20	0.0000
Children's education	15	3	14	3	0.0048

Note: Income and Wealth are measured in terms of Ethiopian Birr, Children's education in terms of levels/grades of education; and, social status in terms of the percentage of people in that village that ask for the individual's advice on some important decisions

Table 2.3 gives the descriptive statistics of the weights respondents attach to each of the four dimensions of the aspirations measures. In a decreasing order, the average weight respondents give is 30% to income, 26% to children's education, 24% to assets, and 20% to social status. In some cases, children's education receives the maximum possible weight and the weight also exhibits the highest dispersion in the data followed by the weight respondents attach to income. We use these weights to calculate the aggregate aspirations index which along with individual indices is presented in Table 2.4. Across gender, males reveal statistically significantly higher aspirations than females. Descriptive statistics further suggest that aspirations increase with the increase in age, education, and wealth. This is also true for the individual aspiration indices in most of these socio-economic groups.

Table 2.3. Mean of relative importance (or weights) respondents attach to the four dimensions of aspirations measures

(Out of the total score of 20), (N=675)

Variable	Mean	Std. Dev.	Min	Max
Income	6.00	2.10	0	15
Assets	4.71	1.43	0	10
Social status	4.09	1.59	0	11
Children's Education	5.23	2.18	0	20

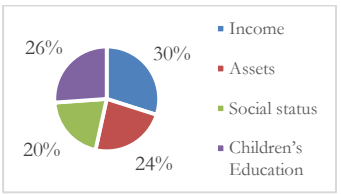


Table 2.4. Average aspirations[11] index and its components by socio-economic groups†

		Normalized aspirations (mean), unweighted			
(N=675)	Aggregate aspirations index (Mean)	Income	Asset	Social status	Children's Education
Whole sample *(Std. Dev. in parenthesis)*	.021 (0.613)	0.0003 (0.050)	0.0001 (0.050)	-0.0005 (0.05)	0.0033 (0.042)
By Sex					
Female (Std. Dev. in parenthesis)	-0.147 (0.571)	-0.007 (0.043)	-0.010 (0.036)	-0.009 (0.056)	-0.003 (0.045)
Male (Std. Dev. in parenthesis)	0.198 (0.606)	0.008 (0.056)	0.011 (0.059)	0.009 (0.041)	0.010 (0.039)
diff = Mean(Male) - Mean(Female), (P value)	*(0.0000)*	*(0.0001)*	*(0.0000)*	*(0.0000)*	*(0.0001)*
Age group					
15-35	-0.16	-0.004	-0.005	-0.009	-0.014
36-55	0.078	0.003	0.002	0.001	0.01
>55	0.081	0.000	0.001	0.006	0.006
Grade of education completed					
0	-0.101	-0.005	-0.008	-0.006	-0.002
0-4	-0.054	-0.004	-0.008	-0.004	0.002
5-8	0.108	0.003	0.005	0.006	0.008
>8	0.307	0.015	0.026	0.008	0.01
Wealth quintile					
Q1	-0.222	-0.010	-0.016	-0.017	-0.005
Q2	-0.067	-0.012	-0.006	0.004	0.004
Q3	0.028	-0.002	0.000	0.004	0.002
Q4	0.062	0.006	0.002	-0.003	0.005
Q5	0.274	0.018	0.019	0.008	0.009

†Descriptive statistics on aspirations by ethnicity and religion is not included because of the limited variation in the data. This is because the study households were drawn from only one region and hence about 81 percent of them belong to one ethnic group, Oromo, while the remaining belong to three other ethnic groups. Similarly, Christians made up about 95 percent of the respondents while the remaining were Muslims.

Having narrow or too-large aspirations-gap may lead to aspirations failure (Ray, 2006). Descriptive statistics on the aspirations-gap index is presented in Table 2.5. The data shows that males have a higher aspirations-gap in the aggregate index and in all individual dimensions except for the aspirations-gap on social status. Mean differences between males and females are statistically significant in all the aspirations-gap indices except for the aspirations-gap on income.

Table 2.5. Aspirations-gap index
(N=675, Mean=1.142 and Std. dev. = 1.553)

	Male		Female		diff = mean(Males') - mean(Females')
	Mean	Std.dev	Mean	Std.dev	P-value
Asp gap index	1.358	1.784	0.937	1.264	0.0004
Asp gap on income	0.171	0.087	0.163	0.084	0.2305
Asp gap on assets	1.253	3.992	0.645	1.863	0.0108
Asp gap on status	0.061	0.051	0.073	0.049	0.0015
Asp gap on education	0.126	0.097	0.111	0.080	0.0284

Recall that *aspirations window* shapes aspirations and this window enlarges with the finding of new information and experience. This may happen, for example, when individuals are exposed to media and information, and experienced some travel and living outside residence. According to Table 2.6, on average, males have statistically

[11] Negative sign indicates that the average outcome of a certain group for a specific indicator is below the average outcome of that indicator for the total sample in the same district

significantly larger exposure to media and information, and have more travel and living experience outside residence[12].

Table 2.6. The aspirations window: average exposure to media and average mobility indices
(Mean, N=675)

	Full sample				Mean by gender		t-test: mean(male)-mean(female)
	Mean	Std. Dev.	Min	Max	Male	Female	(P-value)
Exposure to media index	11.74	2.78	3	15	12.57	10.94	0.0000
Mobility index	11.65	1.87	5	17	11.98	11.33	0.0000

Lastly on aspirations, Table 2.7 presents summary statistics from the qualitative interviews regarding unfulfilled aspirations and the corresponding reasons. These summary results vindicate at least three of the four indicators proposed by Bernard and Taffesse (2014) and employed in this study. For example, the top three (about 87% of the responses) unfulfilled aspirations respondents listed are associated with wealth and education, and the major one reason (about 61%) for the unfulfilled aspirations is lack of money or income. Other important major reasons for unfulfilled aspirations include the absence of institutions nearby (including schools, hospitals) and limited access to utilities (See Table 2.7 for details).

Table 2.7. Unfulfilled aspirations and major reasons behind

	Q.1. What are the three most important things that you wished to achieve in life but couldn't?	**Share**
1	Expand productive asset holdings (including livestock, agricultural tools and machinery, access to more farm land)	30%
2	Improve living standard, own more consumer durables (such as non-productive assets such as modern housing, furniture, television, cell phone….transport vehicle)	39%
3	Start or expand own business, engage in other non-farm income generating activities (such as kiosk, trading, restaurant business…)	5%
4	Improve own level of education or that of children or other family members	17%
5	Move to towns, migrate to foreign countries for better opportunities	1%
6	Use modern care to maintain own health or that of other household members,	1%
7	Use more farm inputs such as fertilizer, chemicals, improved seed; increase yield; use irrigation,	4%
8	Keep savings at the bank	1%
9	Others (throwing a party when a child marries, becoming an athlete, maintain marriage, obtain a civil service position, hire labor)	2%
	Q.2. Why couldn't you achieve them?	
1	Lack of money, high cost of living,	61%
2	Lack of education, lack of knowledge, lack of interest	6%
3	Lack of institutions nearby such as schools, hospitals,	14%
4	Illness or death of family member, lack of medical treatment, death of cattle	4%
5	Poor governance, lack of support, lack of access to utilities (such as clean water, electricity,..)	7%
6	Lack of time, load of family responsibilities	2%
7	Lack of access to resources such as land, credit facility, fear of incurring loss	4%
8	Adverse change in climatic conditions	1%
9	Others (will of God, marriage at early age, lack of labor, lack of market)	2%

[12] Average exposure to media is calculated by summing over the responses for three questions that ask: "How often do you listen to the radio?", "How often do you watch television?", "How often do you use a mobile/cell phone?" Responses were coded as follows: 5=every day, 4=At least once a week, 3=At least once a month, 2=At least once a year, 1= Never. Similarly, average mobility or travel and living experience outside residence is calculated based on responses for five questions that ask: "How often do you go to nearest town?", "How often do you travel outside the *kebele* within the *woreda*?", "How often do you travel outside the *woreda*?" Responses were coded similar to exposure to media. Yet, the two more questions include: "Have you ever lived for more than 6 months outside this kebele?" and "Have you ever lived for more than 6 months outside this woreda?" Responses were coded as 1=Yes, 0 otherwise.

2.3.2.2. Risk and time preferences

Based on the respondents' stated preferences, Table 2.8 shows the share of people that belong to each risk aversion class, listed in a decreasing order of risk aversion. Based on the lottery measure, the distribution of risk aversion in the sample seems to follow a u-shaped graph that depicts an almost equal share of the people at the two extreme ends of risk aversion class. In contrast, the market based risk measure reveals a higher share of the people in the extreme risk aversion class and the share of people continuously decline with the decrease in risk aversion (or a preference for risk loving). Disaggregating the distribution of risk aversion by gender closely follow the overall trend which is u-shaped with the lottery based measure and continuous decline for the market based measure (Figure 2.1). In both measures, however, the share of women in the extremely risk averse class are much greater than the share of women in the least risk averse class while the opposite is true for men.

Table 2.8. Risk preferences based on lottery choices and selling price of a bag of maize
(in Ethiopian Birr, hypothetical payouts) (N=675)

a. Lottery choices (N=675)

Lottery	Head (ETB)	Tails (ETB)	Expected value	Choice in %
1	2.5	2.5	2.5	27
2	2	4	3	15
3	1.5	5	3.25	15
4	1	7	4	15
5	0	10	5	28

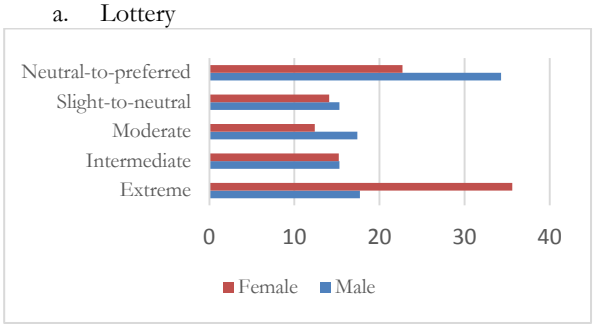
Risk aversion class
Extreme
Intermediate
Moderate
Slight-to-neutral
Neutral-to-preferred

b. Selling price of maize (N=675)

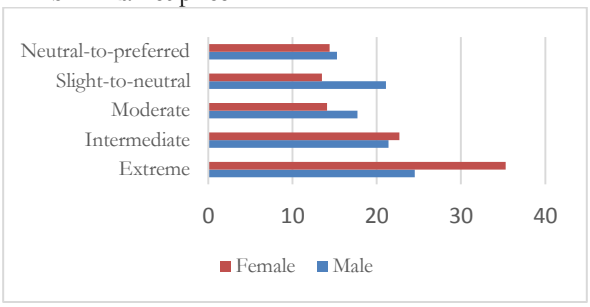
Market	Price 1 (ETB)	Price 2 (ETB)	Expected value	Choice in %
1	250	250	250	30
2	200	400	300	22
3	150	550	350	16
4	100	700	400	17
5	0	1000	500	15

Figure 2.1. The share of population in Each Risk Aversion Class by sex, (%)

a. Lottery



b. Market price



The descriptive statistics on time preferences are presented in (Table 2.9). Individuals are listed according to their discount factor that goes from extremely patient to extremely impatient. We find that the share of people who are extremely impatient is 44 percent while those extremely patient constitute 32% followed by the middle that constitutes about 15%. The shares of people across different levels of discount factors do not change significantly when the data is further disaggregated by gender or by the aspirations profile.

Table 2.9. The share of population by discount rate and aspirations, (%)

Discount factor	Full sample	Female (N=327)	Male (N=346)	Low Asp	High Asp
0 (very patient)	32	32	31	32	31
1	6	4	8	9	4
2	15	15	15	16	14
3	4	2	5	4	3
4 (very impatient)	44	47	41	40	48

2.3.2.3. Aspirations and risk and time preferences

The aggregate aspirations index could be used to classify people into low-aspirations and high- aspirations group by comparison to the corresponding district average. Accordingly, results suggest that about 46% of respondents reveal aspirations lower than the district average. In terms of gender, about 29% of males and 64% of females reveal low aspirations. Based on this definition of aspirations profile, we cross tabulate aspirations with risk aversion, and aspirations with discount rate. According to Figure 2.2a, there is a negative relationship between aspirations and risk aversion and this relationship is more prominent particularly at the two extreme ends of the risk aversion class, when lottery based risk measure is used. The direction of the relationship also holds for the first four risk aversion class when market based measure of risk aversion is used *(*Figure 2.2b). These descriptive statistics provide preliminary evidence on a positive relationship between higher aspirations and less risk aversion behavior. In contrast, we do not find a clear trend on the relationship between aspirations and time discounting (see Figure 2.3). For example, from those people who revealed to be extremely impatient, the share of people with high aspirations is larger than those with low aspirations. In contrast, the opposite is true for the remaining impatience categories.

Figure 2.2. The share of population in each risk aversion class by aspirations (%), (N=675)

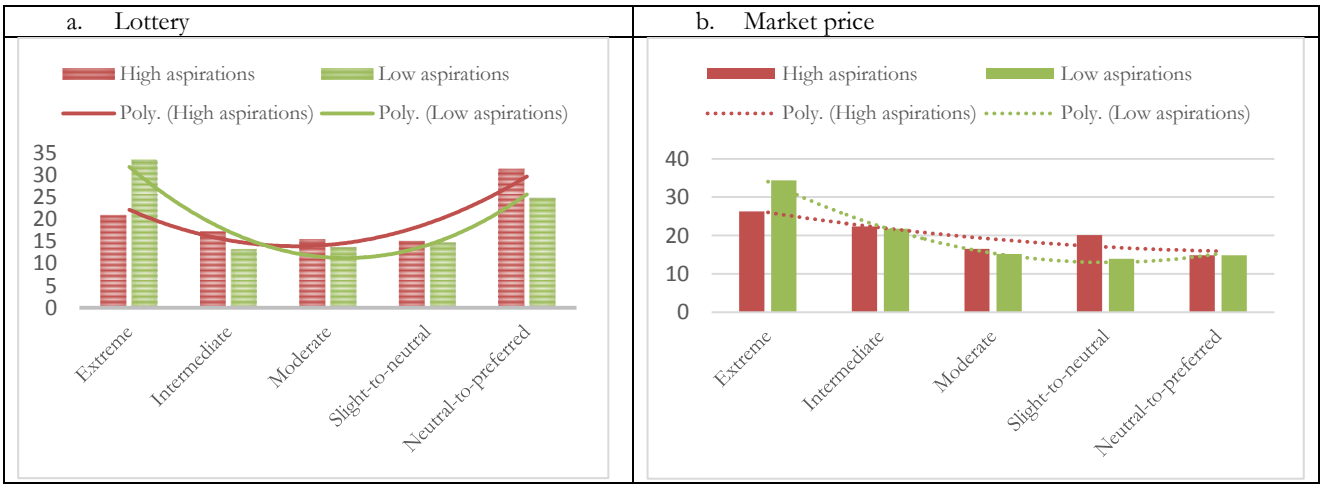
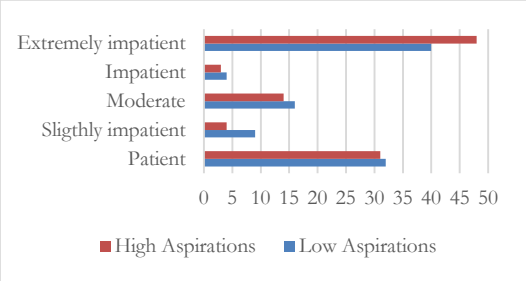


Figure 2.3. The share of people by discount rate and aspirations status



2.3.2.4. Other descriptive statistics

Table 2.10 presents the general overview of sample households on their socio-economic and demographic characteristics. The data suggest that nearly half of the respondents were males. The average age and schooling attainment of respondents was about 47 years and 3.75 years, respectively. The average family size was about 7 people with a 0.37 dependency ratio. The total value of asset holdings has grown between 2006 and 2014 but the agricultural land holdings has decreased during the same period, on average. Further, during the 12 months prior to the survey, about 9 percent of the households, on average, had experienced negative shocks related to weather, price, or illness of family members or livestock. Households are located at a radius of around 20 minutes' walk to the nearest asphalt road or to the farmers' training center. Other service centers such as the output market, the cooperative office, the nearest input dealer, the district town and the nearest micro finance institution are all located in the range of, on average, 33 to 90 minutes of walk one way trip.

Table 2.10. Descriptive statistics on demographics and household endowments

Variable	Obs	Mean	Std. Dev.	Min	Max
Male (dummy)	674	0.49	0.50	0	1
Age (years)	674	46.27	13.15	20	88
Education (level/grade)	674	3.75	3.90	0	16
Household size	375	6.76	2.36	1	16
Dependency ratio	375	0.39	0.21	0	1
Land size in ha (2006)	373	2.87	1.77	0.02	13.06
Value of assets (2006) in ETB	375	11681	11858	21	160809
Land size in ha (2014)	373	2.18	1.43	0	8.25
Value of assets (2014) in ETB at 2006 prices	375	19651	20999	69	209660
Too much rain or flood (dummy)	375	0.09	0.29	0	1
Livestock diseases (dummy)	375	0.08	0.27	0	1
Large increases in input prices (dummy)	375	0.11	0.31	0	1
Death or loss of livestock (dummy)	375	0.09	0.29	0	1
Illness of head/spouse (dummy)	375	0.09	0.29	0	1
Illness of other family member (dummy)	375	0.10	0.29	0	1
Average distance (in minutes) to:					
Market	375	64.42	47.81	1	270
Cooperative office	375	33.44	31.91	1	240
Input dealer	375	72.10	51.44	2	270
Farmer training center	375	22.55	23.01	1	250
Asphalt road	375	18.79	18.46	0	120
Micro finance institution	375	89.95	48.63	5	300

2.4. Empirical strategy

This section outlines the estimation strategies used to address the two research questions. First, we examine the social interactions effect on aspirations. The basic regression model is specified as follows:

$$A_{ij} = \beta\overline{y}_{-ij} + x_{ij}\lambda + \delta_j + \varepsilon_{ij} \quad (3)$$

Where A_{ij} denotes the aspirations outcome for individual i whose reference group is j; $\overline{y}_{-ij}$ denotes the average outcome of i's reference group j; x_{ij} denotes a vector of i's observable characteristics; δ_j denotes the location fixed effects and controls for unobservables common to all at the village and/or district level; and ε_{ij} is a time-variant unobserved component of individual i. We estimate various versions of this model. According to the theory, an individual's aspiration to dimension n is determined by the current average outcome of the reference group in that dimension, given other factors. For example, if A_{ij} represents person i's aspirations to income, then $\overline{y}_{-ij}$ denotes the current average income of the reference group j. The basic equation can be rewritten as follows:

$$A_{ij}^{n} = \beta\overline{y}_{-ij}^{n} + x_{ij}\lambda + \delta_j + \varepsilon_{ij} \quad (4)$$

The basic assumption behind this specification is that the outcomes of all individuals that form the reference group are relevant to drive the aspirations of any given individual, regardless of their relative status compared to the individual. But this may not be necessarily the case for individuals may draw their aspirations rather from those who are richer or those who are doing better, which is referred to as *upward looking aspirations* (Genicot and Ray, 2014). Hence, we re-specify the model considering the average outcome of only those in the reference group who are doing better. The equation takes the following form:

$$A_{ij}^{n} = \beta\overline{y}_{-ij}^{n(above\ i)} + x_{ij}\lambda + \delta_j + \varepsilon_{ij} \quad (5)$$

We estimate both equations 4 and 5 based on different definitions of the "reference group" as well as various measures of aspirations. Reference groups may include individual level social networks, or more broadly all people who live in the same village (see more details in the results section). Yet, recall that, as discussed in the literature review, one's aspirations are determined by own outcome in the past as well as present, the average outcomes of the reference group, access to information and the overall institutional environment. We control for these factors in the regressions. To tackle concerns related to reverse causality, we mainly use lagged values of those explanatory variables which are suspect, for past outcomes affect present level aspirations but not the other way round. Further, since the respondent and individuals in the reference group may have similar

characteristics, the residuals are likely to be correlated. Thus, we cluster the standard errors at the household and village level (i.e. two-way clustering) (Cameron et al., 2011; Petersen, 2009).

Further, when $\overline{y}_{-ij}$ is defined as the aggregate aspirations index of the reference group, it presents more identification challenges for the same variable enters the model as a regressor and a regressand. The basic equation takes the following form:

$$A_{ij} = \beta\overline{A}_{-ij} + x_{ij}\lambda + \delta_j + \varepsilon_{ij} \qquad (6)$$

This specification may suffer from simultaneity bias or a *reflection problem* (Manski, 1993) for the behavior of the individual also affects the mean behavior of their reference group. According to Manski, (1993), a *reflection problem* arises wherein the propensity of an individual to behave in some way varies with: the mean behavior of the group (*peer effects*); the exogenous characteristics of the group (*contextual effects*); and, *correlated effects* wherein individuals in the same group tend to behave similarly because they have similar individual characteristics or face similar institutional environments. The characteristics of the reference group which are exogenous to the individual could include their income, wealth and other outcomes excluding their aspirations. However, these characteristics of the reference group are essentially the ones from which the individual draws their aspirations. Thus, the effect of these factors could be measured jointly with the behavior of the group (i.e through β). The *correlated effects* could be picked up by the location dummies (i.e. through δ).

As a solution to the *reflection problem*, Manski (2000) suggests several strategies along with corresponding conditions. These include:

(1) to use lagged values of the group behavior (i.e. $\overline{A}_{-ij,t-1}$) instead of contemporaneous value ($\overline{A}_{-ij}$). However, this cannot be applicable for this study since this study is based on cross-sectional observations on A.

(2) to assume that "individual behavior varies in a specified nonlinear manner with group mean behavior." But according to Manski (2000), this requires prior knowledge of the correct non-linear function.

(3) to use "some feature of the group behavior other than the mean, such as the median." Yet, this too requires prior knowledge of the "relevant feature of group behavior", (Manski, 2000)

(4) to use instrumental variables (IVs).

We employ the fourth option, using instrumental variables estimation technique. Hence, we estimate the reduced form of equation (6):

$$A_{ij} = \beta\overline{A}_{-ij} + x_{ij}\lambda + \delta_j + \upsilon_i \qquad (7)$$

Where $\overline{\mathbb{A}}_{-ij}$ denotes the predicted value of $\overline{A}_{-ij}$. We provide relevant discussion regarding the validity of the IVs in the results section. Next we outline the methods we use to examine the second research question - the impact of the aspirations-gap (AG) on risk and time preferences.

To examine the effect of the aspirations-gap on risk preferences, we specify the following empirical model:

$$R_i = \alpha_1(AG_i) + \alpha_2(AG_i^2) + w_i\theta + \delta_j + \zeta_i \qquad (8)$$

Where R_i denotes the risk preferences of individual i, AG_i denotes the individual's aspirations-gap index, w_i denotes all exogenous explanatory variables and δ_j denotes location fixed effects and ζ_i denotes the random error. According to Ray (2006), the aspirations-gap affects forward-looking behavior nonlinearly i.e. narrow and very large aspirations-gaps are detrimental while a moderate aspirations-gap is conducive. Thus, to capture this non-linearity, we include the square term of the aspirations-gap index (AG_i^2). This non-linear effect could also be examined using alternative specifications. For example, individuals could be grouped into three categories[13] depending on their aspirations-gap. These groups include narrow AG, moderate AG and very-large AG. Hence, by leaving out the moderate AG as a reference category, we control for two dummies that represent narrow-AG and wide-AG. Accordingly, the model takes the following specification:

$$R_i = \alpha_1(\text{NARROW AG})_i + \alpha_2(\text{WIDE AG})_i + w_i\theta + \delta_j + \zeta_i \qquad (9)$$

By the same token, the AG effect on time preferences (TP_i) could be examined using equations (8) and (9) after including the indicator of risk preferences (R_i) and the interaction term between risk and AG in w_i as explanatory variables. Thus,

$$TP_i = \phi_1(AG_i) + \phi_2(AG_i^2) + z_i\psi + \delta_j + \xi_i \qquad (8')$$

$$TP_i = \phi_1(\text{NARROW AG})_i + \phi_2(\text{WIDE AG})_i + z_i\psi + \delta_j + \xi_i \qquad (9')$$

Where z_i denotes the remaining explanatory variables including risk preferences and ξ_i denotes the random error term. Since the aspirations, risk and time preferences are all perception indicators, it is difficult to find IVs that could affect one but not the other. Hence, to check the robustness of the findings, we use quasi-experimental methods which we discuss later in the results section.

[13] To classify individuals in three groups according to their levels of aspirations-gap index (or AG_i) (i.e. narrow, moderate or very-large), we employ the formula used in (Bandiera and Rasul, 2006) in their categorization of individuals into three relative poverty status as poor, moderate and rich. Accordingly, the level of aspirations-gap of an individual is considered to be: Narrow (if AG_i is < 75% of sample average); Moderate (if AG_i is between 75% and 125% of sample average); Very-large (if AG_i is > 125% of sample average). Alternatively, one could use terciles of AG_i that divide individuals into equal groups and define the first and last tercile as having narrow and very large AG.

2.5. Results and discussion

2.5.1. The effect of social interactions on aspirations

We examine the social interactions effect on aspirations in two parts. First, we define the *aspirations window* (or the reference group) as social networks which we construct using "random matching within sample" technique. Individuals who belong to a network interact with their counterparts, for instance by sharing information and advice, or supporting each other when needed. These interactions may help shape individual behavior. In this context we examine the social interactions effect on aspirations from a "very close cognitive window" or in what Genicot and Ray (2014) referred to as "local aspirations with population neighborhoods" (p.6). In reality, however, individual networks are much broader and the literature also suggests the existence of multiple reference groups. Since it may not be possible to know all relevant reference groups for each individual, treating residents of a certain geographic location as a reference group could help capture more than one reference group. Hence, in our second approach, we define village as a reference group even though individuals who belong to the same village may not necessarily know each other or may not have close relationships. Yet, lack of acquaintance or individual relationships amongst each villager does not necessarily lead to the exclusion of some from their cognitive windows. This is because, individuals could still compare their status even from the distance by observing tangible wealth indicators such as livestock holdings, housing structure, etc - which all would help shape one's aspirations.

2.5.1.1. Social networks as a reference group

We begin by looking at the social interactions effect on aspirations using individual dimensions (i.e. income, wealth, social status and children's education). Results in Table 2.11, columns 1 to 8, show that, after controlling for own socio-economic characteristics, experience of various shocks and the location fixed effects, there does not seem to be a statistically significant relationship between one's aspirations and the average present outcome of the reference group in any of the four individual components. The basic assumption behind this specification (equation 4) is that the present outcomes of all individuals that form the reference group are relevant to drive one's aspirations, regardless of their relative status compared to the individual. Yet, this may not be necessarily the case for individuals may draw their aspirations rather from those who are richer or who are doing better, which is referred to as "upward looking aspirations" (Genicot and Ray, 2014, p.6). Hence, we re-estimate the model (equation 5) considering the average outcomes of only those in the reference group who are doing better. As Table 2.12, columns 1, 3, 5 and 7 suggest, in deed there is a statistically significant relationship between a person's aspirations (in all dimensions) and the corresponding average outcomes of the reference group. Yet, when self-reported present outcomes (columns 2, 4, 6 and 8) are controlled for, some of the coefficients that proxy for the social interactions effect lose their statistical significance or in some cases become negative. This lack of robustness may come about for many reasons including measurement error the effect of which could be minimized through standardisation of the individual dimensions and hence by using the aggregate aspirations index.

Table 2.11. The effect of social interactions on each dimension of aspirations
(Using the average outcome of all in the reference group)

	(1) Inc1	(2) Inc2	(3) Assets1	(4) Assets2	(5) Status1	(6) Status2	(7) Educ1	(8) Educ2
Peers' Ave. income(ln)	0.00	-0.02						
	(0.07)	(0.04)						
Peers' Ave. V.assets (ln)			-0.01	-0.05				
			(0.06)	(0.04)				
Peers' Ave. S.status (ln)					0.15	0.10		
					(0.11)	(0.08)		
Peers' Ave. ch.education							0.02	0.00
							(0.05)	(0.04)
Network size	0.09***	0.03*	0.03	0.01	0.02***	0.01**	0.10*	0.12**
	(0.02)	(0.01)	(0.03)	(0.02)	(0.01)	(0.01)	(0.06)	(0.06)
Other 'internal' factors	No	Yes	No	Yes	No	Yes	No	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	635	633	635	633	635	633	635	633
R-squared	0.213	0.579	0.263	0.586	0.092	0.393	0.13	0.262

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01.
Note: For full results, see the appendix, Table A2. 1 .

Table 2.12. The effect of social interactions on each dimension of aspirations
(Using the average outcome of those who are richer than the respondent)

	(1) Inc1	(2) Inc2	(3) Assets1	(4) Assets2	(5) Status1	(6) Status2	(7) Educ1	(8) Educ2
Ave. of Peers' above Ave. income(ln)	0.606***	0.082**						
	(0.048)	(0.035)						
Ave. of Peers' above Ave. V.assets (ln)			0.493***	0.000				
			(0.085)	(0.075)				
Ave. of Peers' above Ave. S.status (ln)					0.586***	-0.033		
					(0.154)	(0.112)		
Ave. of Peers' above Ave. ch.education							0.266***	-0.198**
							(0.077)	(0.078)
Network size	0.047	0.008	0.033	0.019	0.018***	0.013*	0.190	0.135
	(0.029)	(0.019)	(0.031)	(0.024)	(0.006)	(0.007)	(0.120)	(0.102)
Other 'internal' factors	No	Yes	No	Yes	No	Yes	No	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	510	508	481	481	476	474	456	455
R-squared	0.309	0.496	0.303	0.518	0.177	0.380	0.166	0.297

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Note: For full results, see the appendix, Table A2. 2.

Hence, we regress the aggregate aspirations index on the average aspirations index of the reference group and other controls (equation 6). As before, results in Table 2.13, columns 1 to 3, suggest there is no evidence of a statistically significant social interactions effect when the group average outcome is calculated by including all individuals in a network regardless of their relative position to the individual. However, when we consider only those who have higher aspirations index than the individual, we find a positive and statistically significant social interactions effect on aspirations (columns 4 to 6). Results are robust to different specifications and this perhaps suggests that using the aggregate aspirations index may better proxy for one's overall aspirations than using individual dimensions of aspirations. This may also reflect the secondary effect of social interactions on aspirations besides those derived from the pure observation of peers' outcomes. Nonetheless, these results could still suffer from *reflection problem* (Manski, 1993) for the behavior of the individual could also affect the mean

behavior of the reference group or network that the individual belongs to. The analysis that solves for a reflection problem and the discussion of other results including by gender group are deferred to the next section.

Further, notice that the coefficient that indicates network size (or size of the reference group) is positive and statistically significant in most of the specifications (see Table 2.11, Table 2.12, and Table 2.13). This perhaps underlines the importance of having a wider reference group for stronger social interactions effect. This will be checked in the next section that examines the effect of social interactions on aspirations by taking village as a reference group.

Table 2.13. The effect of social interactions on aspirations: social networks as reference group

	(1) Asp. Av.	(2) Asp. Av.	(3) Asp. Av.	(4) Asp. ab. Av.	(5) Asp. ab. Av.	(6) Asp. ab. Av.
Peers' Ave. Asp.index	-0.030	-0.025	-0.047			
	(0.090)	(0.083)	(0.075)			
Av. of Peers' above av.Aspindex				0.436***	0.425***	0.370***
				(0.058)	(0.054)	(0.043)
Network size	0.048***	0.044***	0.027*	0.045***	0.044***	0.039***
	(0.016)	(0.016)	(0.016)	(0.009)	(0.009)	(0.010)
Other 'internal' factors	No	Yes	Yes	No	Yes	Yes
Own present outcomes	No	No	Yes	No	No	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	635	633	633	519	518	518
R-squared	0.196	0.238	0.328	0.418	0.431	0.492

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Note: For full results, see the appendix, Table A2. 3.

2.5.1.2. Village as a reference group

Following the same procedure as in the preceding section, we regress each individual component of aspirations on the corresponding village level (average) outcome and other controls. As columns 1 to 8 in Table 2.14 show, we find a positive and statistically significant social interactions effect in all but the aspirations to education. These results seem to confirm what has been implied toward the end of the previous section - that having a wider reference group could provide stronger social interactions effect. In order to check for evidence of upward looking aspirations, we re-estimate the model considering the average outcomes of only those who are doing better than the village average as a reference group. As results in Table 2.15 (columns 1 to 8) show, the magnitude of the coefficients that indicate the effect of social interactions has increased in all four dimensions of aspirations. In contrast, we find a negative but not statistically significant social interactions effect on aspirations to education. While this evidence of negative social interactions effect on aspirations to education may well be interpreted in terms of frustration (or envy) when the gap between the aspired and current level of children's education is very large, it may also be associated with other factors such as measurement error. Further, since these individual components of aspirations may mean differently across people, the aggregate aspirations index may be preferred for better inference since it accounts for the weight each individual attaches to each of the four indicators.

Hence, we re-estimate the model (equation 6) using the aggregate aspirations index on the village level aggregate aspirations index and other controls. Surprisingly, as Table 2.16 (columns 1 to 3) show, there seems to be no statistically significant social interactions effect of aspirations. Yet, when we consider only those people with aspirations index greater than the village average as a reference group, we find a positive and statistically significant social interactions effect, showing evidence of upward looking aspirations (columns 4 to 6). Nevertheless, as pointed out before, this specification may still suffer from *reflection problem* for the same indicator enters regressions both as a dependent and explanatory variable. Hence, to correct for the potential endogeneity bias that might arise due to this simultaneity, we re-estimate the model (equation 7) using two-stage least squares estimation (2SLS) (or instrumental variables estimation) technique. Yet, finding instruments which are related to the endogenous variable, i.e. the average level of aspirations of other people in the village, but which are exogenous to the individual's aspirations level is not easy. After extensive search in the data, we find three instrumental variables which pass the statistical tests for a valid instrument (i.e. relevance and exogeneity)[14]. Apart from satisfying the requirements of statistical tests, however, instruments should also be theoretically plausible. The three instruments we use are two indicators of subjective well-being measured in the past (i.e. during 2006 survey) and an index of the father's level of involvement in the past in different institutions. Next we discuss how these instruments were measured and also their theoretical relevance in some detail.

Table 2.14. The effect of social interactions on each dimension of aspirations
(Using average outcome of all in the reference group)

	(1) Inc1	(2) Inc2	(3) Assets1	(4) Assets2	(5) Status1	(6) Status2	(7) Educ1	(8) Educ2
Vill. ave. income(ln)	0.000***	0.000**						
	(0.00)	(0.00)						
Present income(ln)		0.890***						
		(0.04)						
Vill. ave. v.assets(ln)			0.000**	0.000*				
			(0.00)	(0.00)				
Present v.assets(ln)				0.724***				
				(0.05)				
Vill. ave. s.status(ln)					0.010***	0.007***		
					(0.00)	(0.00)		
Present s.status(ln)						0.355***		
						(0.08)		
Vill. ave. ch.education							0.131	0.130
							(0.15)	(0.16)
Present ch.education								0.329***
								(0.07)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.222	0.592	0.285	0.604	0.081	0.390	0.121	0.248
Observations	665	663	665	663	665	663	665	663

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Note: For full results, see the appendix, Table A2. 4.

[14] Several tests were conducted. The Stock and Yogo (2005) test of weak instruments was used for various specifications. The null hypothesis of weak instrument was rejected using either a minimum value of 10 as a rule of thumb for *F* statistic, or the minimum eigenvalue statistic to tolerate distortion for a 5% Wald test based on the 2SLS and LIML estimators. Instruments also satisfy Hansen's test of over identification. See Appendix Table A2. 14 for various tests of instrument validity, including relevance and falsification test.

Table 2.15. The effect of social interactions on each dimension of aspirations
(Using average outcome of those who are richer than the village average)

	(1) Inc1	(2) Inc2	(3) Assets1	(4) Assets2	(5) Status1	(6) Status2	(7) Educ1	(8) Educ2
Mean outcome above village average								
Income(ln)	0.566***	0.204**						
	(0.09)	(0.08)						
Present income(ln)		0.887***						
		(0.04)						
V.assets(ln)			0.338***	0.145*				
			(0.09)	(0.08)				
Present v.assets(ln)				0.721***				
				(0.05)				
S.status(ln)					0.502**	0.075		
					(0.25)	(0.20)		
Present s.status(ln)						0.356***		
						(0.09)		
Ch.education							-2.991	-5.946
							(4.07)	(4.92)
Present ch.education								0.339***
								(0.08)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	665	663	665	663	665	663	665	663
R-squared	0.231	0.593	0.290	0.604	0.079	0.386	0.122	0.252

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Note: For full results, see the appendix, Table A2. 5.

Table 2.16. The effect of social interactions on aspirations
(Based on average outcome of all in the reference group as well as those with more than village average)

	(1) AvAsp1	(2) AvAsp2	(3) AvAsp3	(4) AbovAv1	(5) AbovAv2	(6) AbovAv3
Vill. ave. Asp. Index	0.32	0.24	0.08			
	(0.29)	(0.33)	(0.30)			
Mean Aspindex Above village av				0.54***	0.46***	0.40***
				(0.10)	(0.14)	(0.13)
Present income(ln)			0.24***			0.23***
			(0.02)			(0.02)
Present v.assets(ln)			0.04			0.04
			(0.03)			(0.03)
Present s.status(ln)			0.20***			0.19***
			(0.04)			(0.04)
Present ch.education			0.02***			0.02***
			(0.01)			(0.01)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	665	663	663	665	663	663
R-squared	0.193	0.236	0.331	0.208	0.247	0.340

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Note: For full results, see the appendix, Table A2. 6.

The two subjective well-being indicators were measured as follows. Fist, respondents were asked: "How does your household's welfare compare with that of other households in the village?" The choices were "1=better than others", "2=worse than others", "3=not different from others." We recode the values for "Not different from others" from "3" to "0" so that it could serve as a reference for individuals in that position may not be motivated to aspire for lack of a reference group with higher achievements. We recode the values for "worse than others" from "2" to "-1" so that it would have a distinct effect from those who think they are "better than others." The resulting values are -1, 0 and 1. The second subjective well-being indicator asks, "On a ten scale life

ladder where 0 represents the worst possible life and 9 represents the best possible life, where on the ladder do you feel you personally stand at present?" Responses were coded from 0 to 9. Now, since an individual may aspire for a better outcome or may fail to do so depending on their own perception about their well-being in comparison to others, subjective well-being contributes to aspirations formation. Hence, it is relevant. But again, since subjective well-being is a perception which is internal to the individual, it is unlikely to be known by other people and hence this cannot directly influence the aspirations of other people. In this case, subjective well-being can be considered exogenous not to mention that it was measured sometime in the past.

The second identifying variable is the father's role in the past in five different groups or institutions such as religious group, village committee, parental committee at school, *iddir* (funeral societies), *iqqub* (savings group), and cooperative. The question asks the level of the father's involvement in terms of being "not a member", "inactive member", "active member" and "official leader" which were given values from 1 to 4, respectively. Summation of the values from the five groups gives an index, a summary measure of a father's involvement in institutions. The level of involvement (e.g. membership or leadership position) in different institutions, particularly in the rural setting of a developing country, determines the level of exposure one may have to various pieces of information, ideas and opportunities which all would help shape one's forward-looking behavior. Since parental behavior very much affects children's behavior, we argue that the identifying variable is relevant and also satisfies the exogeneity assumption. Of course one may think of a scenario where the exogeneity assumption may collapse given that aspirations are socially determined. Nonetheless, we argue that the social effect of parental involvement in institutions on aspirations is theoretically weak due to decay, for the study subjects are adults whose average age is 46 years. With this in mind, next we discuss results from the 2SLS estimations.

Results in Table 2.17 show that there is a positive and statistically significant social interactions effect on aspirations and this finding is robust to different specifications (columns 1 to 6). According to the results a standard deviation increase in the average aspirations index in the village[15] is associated with a $(0.59 \times 0.078) = 0.046$ to $(0.98 \times 0.078) = 0.076$ point increase in the individual's aspirations index. This is a $(0.046/0.613) = 0.075$ to $(0.076/0.613) = 0.124$ standard deviations increase in aspirations. Notice that the magnitude of the social interactions coefficient increases when we include more controls such as indicators of shocks experienced in the past that negatively affected the individual, and when we control for indicators of other internal factors such as internal locus of control, trust in others, risk and time preferences. This perhaps suggests that the effect of social interactions on aspirations is larger for people with strong personality traits. Further, the magnitude of the coefficient estimates is very much relevant for policy as it shows the power of social interactions in raising aspirations. In what follows, we provide a brief discussion regarding other factors that determine aspirations. In the interest of space, we restrict the discussion of results to the full sample and from the IV estimations technique.

[15] The mean and standard deviation of the aspirations index of the individual are (0.021 and 0.613) and that of others' in the village are (0.021 and 0.078).

Table 2.17. The effect of social interactions on aspirations
(Using the average outcome of all in the reference group (IV estimates))

	(1) r1	(2) r2	(3) r3	(4) r4	(5) r5	(6) r6
Vill. ave. Asp. Index	0.70*	0.76*	0.79**	0.98***	0.81**	0.59*
	(0.38)	(0.39)	(0.34)	(0.29)	(0.34)	(0.34)
Male	0.23***	0.23***	0.22***	0.18***	0.19***	0.11*
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Education level	0.03***	0.04***	0.04***	0.03***	0.03***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HH size	0.28***	0.29***	0.30***	0.29***	0.31***	0.07*
	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)
V.of assets_2006 (ln)	0.08***	0.08***	0.08***	0.07***	0.04*	0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Dist. coop office (minutes)(ln)		0.03	0.04*	0.04*	0.04**	0.05**
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Illness of other family			-0.13***	-0.10**	-0.10**	-0.09**
			(0.04)	(0.05)	(0.04)	(0.04)
Locus of control				0.18***	0.16***	0.11*
				(0.06)	(0.06)	(0.06)
Trust index				0.03**	0.04***	0.03*
				(0.01)	(0.01)	(0.02)
Real PC expenditure2014(ln)					0.14***	
					(0.03)	
Present income(ln)						0.22***
						(0.02)
Present s.status(ln)						0.20***
						(0.04)
Present ch.education						0.02**
						(0.01)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	649	649	649	647	647	647
r2	0.20	0.21	0.22	0.24	0.26	0.32

Standard errors (clustered at village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Note: For full results, see the appendix, Table A2. 7.

According to Table 2.17, gender of the respondent is statistically significantly associated with high aspirations implying that being male is associated with aspirations that are about (0.11/0.613) = 0.18 to (0.23/0.613) = 0.38 standard deviations higher than those of women (columns 1 to 6). Perhaps this is because existing customs and traditions could be more supportive of males to explore different opportunities including during childhood such as attending school, make travels to bigger cities, engage in more interactions outside the household, etc. The cumulative effect of all these would help broaden their *aspirations window* and hence their aspirations. We also find that a standard deviation increase in the level of education would lead to an increase in the aspirations index by (0.02 × 3.96) = 0.078 to (0.04 × 3.96) = 0.158 points (columns 1 to 6). This is about (0.078/0.613) = 0.13 to (0.158/0.613)= 0.26 standard deviations increase in aspirations. The magnitude of the effect is large given that the average aspirations index in the sample is 0.021. The reason could be that having some level of education may help in seeking out for new pieces of information and utilizing them, and increasing one's analytical skills and ultimately their aspirations. In fact, since the average level of education in the study households is 3.75 years, this identified effect of having some more years of education on aspirations is in line with the wider evidence on the importance of primary education for various outcomes in developing countries (e.g. Banerjee and Dufluo, 2011), and more specifically in Ethiopia on - farm productivity (e.g. Weir, 1999) and fertilizer adoption (Asfaw and Admassie, 2004).

Household size is also positively and statistically significantly associated with an increased aspirations index. This could be because, having larger family size may avail more labor power, a critical input to do farming which is a labor intensive sector and the main stay of the study households. In addition, having larger family size could also help diversify household livelihood strategies for adult family members could engage in other income generating activities which in turn would have a direct benefit in terms of increased aspirations. In fact, this argument is already supported by the fact that the dependency ratio in the household is negatively associated with aspirations. Further, we also find wealth status in the past to be statistically significantly associated with the aspirations index, which is again in line with expectations. This is because, as discussed in the theoretical literature (e.g. Ray, 2006, Appadurai, 2004; and Dalton et al, 2014), poverty imposes external constraints (e.g. lack of access to information or credit to acquire skills, etc) reducing the productivity of the poor and hence their "navigational capacity to aspire." Further, this could illustrate how poverty impedes cognitive functions, as empirical evidence by Mani et al (Mani et al., 2013) show, and this may limit their aspirations. While it is possible that aspirations might lead to higher wealth (reverse causation), it is important to note that wealth measured in the past is considered (Table 2.17, columns 1 to 4), which cannot be affected by present level aspirations. Yet, when we control for perceived level of present outcomes such as income, wealth, social status and children's education (Table 2.17, columns 5 and 6), the social interactions effect remains positive and statistically significant, confirming the robustness of findings. As a side note, a later chapter examines the effect of aspirations on current level outcomes such as income, food security and subjective well-being.

As pointed out in the literature, aspirations are formed and developed in response to different environments and circumstances. In this context, out of the six types of shocks experienced[16] and that we control for, we only find that illness of family members to be negatively and statistically significantly associated with the aspirations index. Perhaps, while wealth status could serve as a cushion against shocks of this nature in terms of the resource requirements (e.g. Yilma et al, 2014), it may not immune one from the depressing psychological effects that are detrimental to aspirations. Further, from factors that are "internal"[17] to the individual, we find the "trust in others"[18] and "internal locus of control (ILC)"[19] indicators to be positively associated with the aspirations index

[16] Individuals were asked if they were negatively affected by a serious shock in the last twelve months. These specific shocks include: "Too much rain or flood, Livestock diseases, Large increases in input prices, Death or loss of livestock, Illness and disability of the breadwinner or wife, Illness of other family members." Indicators were asked as binary choice (1 if yes, 0 otherwise)

[17] We control for indicators of *internal locus of control, trust in others, time and risk preferences*. We construct an index for internal locus of control from 14 statements (Levenson, 1981), which reflect the respondent's perception that life outcomes are controlled by: (1) oneself (internality), (2) powerful people, (3) chance. Similarly, we construct an index of "Trust in others" from 2 statements which reflect the respondent's sense of trust in the society. Time and risk preferences are measured as explained before.

[18] The actual set of statements used to measure *trust* were: (1) "Most people can be trusted" (2) "I would trust my neighbors to look after my field if I had to travel for two months." The responses and corresponding scores are: 4 'strongly agree', 3 'agree', 2 'disagree', or 1 'disagree strongly'. The scores from the two responses were summed and standardized to give "Trust" index.

[19] The actual set of statements used to measure *ILC* were: (1) *Chance*: "To a great extent my life is controlled by accidental/chance happenings", "Often there is no chance of protecting my personal interests from bad luck happenings", "When I get what I want, it's usually/mostly because I'm lucky", "My experience in my life has been that what is going to happen will happen", "It's not always wise for me to plan too far ahead because many things turn out to be a matter of good or bad fortune"; (2) *Powerful others* "I feel like what happens in my life is mostly determined by powerful people", "My life is chiefly controlled by other powerful people", "People like myself have very little chance of protecting our personal interests when they conflict with those of more powerful people", "Getting what I want requires making those people above me (people with higher status) happy with me", "In order to have my plans work, I make sure that they fit in with the desires of people who have power over me"; and (3) *Internality*: "When I make plans, I am almost certain/guaranteed/sure to make them work", "I can mostly determine what will happen in my life", "I am usually able to protect my

at less than 1 percent level of statistical significance. These two results are in line with expectations. For example, *trust in others* may increase one's openness for interaction which might expose the individual to new information and opportunities, which are again key factors in determining aspirations. Similarly, having *internal locus of control* is perhaps the necessary condition for forward-looking behavior. This is because it is only when one thinks that life outcomes are controlled by oneself that one would aspire and put some effort to achieving them. In line with this, Ghosal et al, (2013) use a randomized control trial and show that aspirations could be enhanced through less costly interventions such as the provision of psychological trainings or what the authors referred to as "dream building."

2.5.2. The effect of social interactions on aspirations across gender

It is possible that the analysis based on aggregated data may hide some facts, and results in this study seem to suggest just that. We examine the effect of social interactions on aspirations separately for male and female respondents. According to Table 2.18, the effect of social interactions is statistically significant only for female respondents. Results suggest that a standard deviation increase in the average aspirations index in the village[20] is associated with a (0.87 × 0.078) = 0.068 to a (1.45 × 0.078) = 0.113 points increase in females' aspirations index (columns 1 to 4). This is a (0.068/0.571) = 0.119 to (0.113/0.571) = 0.198 standard deviations increase in aspirations. As we showed in the descriptive statistics, males had statistically significantly larger exposure to media and information, and more travel and living experience outside their residence. This might broaden their aspirations window and hence their reference group could be wider than the village average. Thus, interactions or what happens at the village level may not substantially affect their aspirations. In contrast, females may have limited information set and less exposure outside their residence. Thus, having some form of social interactions at the village may just compensate and broaden their aspirations window and hence their aspirations.

Table 2.18. The effect of social interactions on aspirations across gender (IV estimates)

	Female				Male			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Vill. ave. Asp. Index	1.12***	1.16***	1.45***	0.87***	0.28	0.29	0.23	0.04
	(0.37)	(0.37)	(0.39)	(0.27)	(1.00)	(0.89)	(0.91)	(0.87)
Present income(ln)				0.18***				0.24***
				(0.06)				(0.04)
Present v.assets(ln)				0.02				0.05
				(0.04)				(0.04)
Present s.status(ln)				0.19***				0.18***
				(0.05)				(0.04)
Present ch.education				0.02***				0.01
				(0.01)				(0.01)
Shocks experience	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Cognitive indicators	No	No	Yes	Yes	No	No	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	332	332	332	332	317	317	315	315
r2	0.08	0.09	0.16	0.24	0.22	0.23	0.24	0.33

Standard errors (clustered at village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Note: For full results, see the appendix, Table A2. 8.

personal interests (I can usually look after what is important to me), "When I get what I want, it's usually because I worked hard for it", "My life is determined by my own actions". The choice of responses and corresponding scores were: 4 'strongly agree', 3 'agree', 2 'disagree', or 1 'disagree strongly'. Responses were coded in such a way that high scores always indicate a more internal locus of control. The scores from the 14 responses were summed and standardized to give "internal locus of control" index.

[20] The mean and standard deviation of the aspirations index of females are (-0.148 and 0.571).

2.5.3. The effect of aspirations (gap) on risk and time preferences

Recall that, beside the direct motivation effects, the other hypothesised channels through which aspirations may affect forward-looking behavior is through their effect on risk and time preferences. Hence, we set to examine if aspirations (aspirations-gap (AG)) affect risk and time preferences. To account for the non-linear effects of aspirations on forward looking behavior (Ray, 2006) – that moderate AG is conducive while narrow and very-large AG are detrimental, the AG indicator enters regressions as a continuous variable along its square term, or dummy variables that represent narrow and very-wide or moderate[21] aspirations-gap. We begin the discussion with simple mean comparison tests using the latter. According to Table 2.19, the mean value of risk loving (or reduced risk aversion) of individuals with moderate AG is higher than those with narrow or very-large AG for the whole sample and for females alone. The difference is statistically significant across the two indicators used to measure risk behavior (i.e. based on lottery and market price of maize). In contrast, we fail to find a statistically significant difference on the mean values of discount rate among individuals with moderate AG and others, for the full sample and for males. Females with narrow or very-large aspirations-gap seem to have statistically significantly higher discount factor by comparison to females with moderate AG.

Table 2.19. Mean comparison of risk and time preferences by aspirations-gap‡

	Narrow or Large AG (N=568)		Moderate AG (N=100)		t-test: mean difference (Moderate AG -Narrow/large AG)
***Whole sample (Mean,* Std. Dev.)**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**p-value**
Lottery (3.03, 1.58)	2.92	1.57	3.64	1.51	0.0000
Market (2.65, 1.44)	2.58	1.43	3.02	1.44	0.0048
Composite risk index (5.68, 2.71)	5.50	2.69	6.66	2.63	0.0001
Discount factor (2.22, 1.75)	2.25	1.73	2.08	1.86	0.3759
Female	(N=306)		(N=37)		
Lottery (2.73, 1.60)	2.68	1.59	3.30	1.60	0.0257
Market (2.50, 1.45)	2.43	1.45	3.03	1.38	0.0179
Composite risk index (5.23, 2.77)	5.11	2.75	6.32	2.80	0.0116
Discount factor (2.17, 1.73)	2.24	1.71	1.57	1.79	0.0262
Male	(N=262)		(N=63)		
Lottery (3.33, 1.51)	3.21	1.5	3.84	1.44	0.0026
Market (2.81, 1.41)	2.76	1.39	3.02	1.49	0.1885
Composite risk index (6.14, 2.57)	5.96	2.55	6.86	2.53	0.0127
Discount factor (2.28, 1.78)	2.26	1.76	2.38	1.84	0.6375

‡Note: risk aversion declines with the increase in risk aversion index

Results from the multivariate analysis are presented from Table 2.20 to Table 2.23. After controlling for exogenous factors that might determine risk behavior, including experiencing various shocks in the past, along with indicators of relative wealth and other household characteristics, we find that the aspirations-gap is statistically significantly related to minimized risk aversion (or a preference for risk taking) behavior, when the lottery based risk measure is used (See Table 2.20, column 1)[22]. In this instance, a standard deviation increase in

[21] As an alternative to Bandiera and Rasul (2006) approach, we used terciles to classify individuals into three relative groups according to their levels of aspirations-gap (i.e. narrow, moderate or very-wide). But, results from subsequent analysis did not differ from the alternative approach.

[22] By summing over the two risk measurements, we construct a composite risk measure. Corresponding results from regressions (not reported) closely follow the results based on the lottery outcome.

the aspirations-gap[23] index is associated with a (0.21 × 1.553) = 0.326 point increase in risk aversion index. This is a (0.326/1.58) = 0.206 standard deviation reduction in risk aversion, or about (0.326/3.03) = 11 percent increase over the mean risk aversion index of 3.03. The negative and statistically significant coefficient of the square term of the AG indicator confirms the hypothesised non-linear effect of the AG on risk behavior: when the AG becomes extremely large, its effect on risk-taking behavior declines. To check this non-linearity further, we re-estimate the model (equation 9) controlling for two dummies that respectively proxy for narrow and very-large AG instead of the continuous variable of the AG index and its square term (equation 8). By comparison to those with moderate AG, we find that individuals with narrow or very-large AG are statistically significantly more risk averse, on average, and results are robust across specifications and in line with the theory (Table 2.20, columns 5 to 8). According to these results, individuals with narrow AG, as opposed to those with moderate AG, have a risk aversion index in the range of 0.32 to 0.65 less points. This means that they have a risk aversion that is (0.32/1.44) = 0.22 to (0.65/1.58) = 0.41 standard deviations higher than those with moderate AG. The corresponding risk aversion of those with large AG is (0.38/1.44) =0.26 to (0.49/1.58) = 0.31 standard deviations higher than those with moderate AG.

Table 2.20. The effect of aspirations-gap on risk aversion

	(1) Lottery11	(2) Lottery12	(3) Market11	(4) Market12	(5) Lottery21	(6) Lottery22	(7) Market21	(8) Market22
Asp.Gap index	0.21*	0.18	0.08	0.05				
	(0.12)	(0.12)	(0.10)	(0.10)				
Squ.of Asp.Gap~x	-0.02*	-0.02	-0.01	-0.01				
	(0.01)	(0.01)	(0.01)	(0.01)				
Wide Asp.Gap					-0.47**	-0.49**	-0.37*	-0.38*
					(0.21)	(0.21)	(0.20)	(0.20)
Narrow Asp.Gap					-0.65***	-0.62***	-0.36**	-0.32*
					(0.18)	(0.18)	(0.17)	(0.17)
Distance to services	No	Yes	No	Yes	No	Yes	No	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	666	666	666	666	666	666	666	666
r2	0.08	0.10	0.06	0.08	0.10	0.11	0.07	0.08

Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Note: For full results, see the appendix, Table A2. 9.

Uncertainty regarding future outcomes heavily influence time preferences. Hence, some people may prefer "shorter and sooner" reward to "larger and later" reward for their investment. The discount factor for the former group of people would be higher than that of the later. After controlling for indicators of risk behavior, the interaction term between risk and the AG, and other factors, we find that there is a positive and statistically significant non-linear effect (Table 2.21, columns 1 and 2) of the aspirations-gap on discount factor, implying that the increase in AG is strongly and non-linearly associated with impatience or a preference for shorter and sooner reward. Results, however, are not robust to different specifications. For example, neither of the two coefficients that proxy for narrow and very-wide aspirations-gap is statistically significantly associated with discount factor (Table 2.21, columns 3 & 4).

[23] The mean and standard deviation of the aspirations-gap index are: (1.142 and 1.553) for the whole sample, (0.937 and 1.264) for females, and (1.358 and 1.784) for males.

Table 2.21. The effect of aspirations-gap on time discounting

	(1) DisFact11	(2) DisFact12	(3) DisFact21	(4) DisFact22
Asp.Gap index	0.35**	0.38**		
	(0.16)	(0.16)		
Squ.of Asp.Gap~x	-0.04**	-0.04**		
	(0.02)	(0.02)		
Wide Asp.Gap			0.32	0.35
			(0.27)	(0.27)
Narrow Asp.Gap			0.15	0.14
			(0.20)	(0.20)
Distance to services	No	Yes	No	Yes
Other controls	Yes	Yes	Yes	Yes
Observations	666	666	666	666
r2	0.08	0.08	0.07	0.08

Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Note: For full results, see the appendix, Table A2. 10.

2.5.4. The effect of AG on risk aversion and discount factor across gender

Difference in access to information and economic opportunities jointly with cultural factors might affect aspirations across gender groups differently. In fact, we have shown evidence in the descriptive statistics that males had higher levels of aspirations in each of the four dimensions of aspirations as well as in the aggregate index. This was further confirmed using regression analysis that after controlling for other factors, being male is significantly related to having higher aspirations (see Table 2.17, for example). While it may not be generally the case, this difference might as well be reflected in terms of the AG by males and females, which in turn might lead to differences in time discounting and risk preferences. Estimating the determinants of risk behavior separately for males and females results in a statistically significant coefficients of the AG and its square term only for females, suggesting evidence of the non-linear effects of the AG on women's risk aversion behavior (Table 2.22, column 1). In this instance where the lottery based risk measure is used, a standard deviation increase in the aspirations-gap index is associated with a $(0.37 \times 1.264) = 0.47$ increase in risk aversion index. This is a $(0.47/1.60) = 0.294$ standard deviation reduction in risk aversion, or about $(0.47/2.73) = 17$ percent increase over the mean risk aversion index of 2.73. This is consistent with the mean comparison test result which suggests that females with moderate AG had a statistically significantly higher index of risk loving (or minimized risk aversion) than females with narrow or very-large AG (see Table 2.19). Consistent to this, results from the alternative specifications show that having narrow AG is negatively and statistically significantly correlated to minimized risk aversion for both genders (Table 2.22, columns 3, 4 and 7). However, it is only for females that the result is robust across the two indicators of risk aversion (i.e. lottery and market risk).

Table 2.22. The effect of aspirations-gap on risk aversion across gender

	Female				Male			
	(1) LotteryF1	(2) MarketF1	(3) LotteryF2	(4) MarketF2	(5) LotteryM1	(6) MarketM1	(7) LotteryM2	(8) MarketM2
Asp.Gap index	0.37*	0.20			0.12	-0.03		
	(0.20)	(0.18)			(0.14)	(0.13)		
Squ.of Asp.Gap index	-0.05**	-0.02			-0.01	-0.00		
	(0.02)	(0.02)			(0.02)	(0.02)		
Wide Asp.Gap			-0.37	-0.47			-0.60**	-0.36
			(0.38)	(0.34)			(0.24)	(0.24)
Narrow Asp.Gap			-0.62**	-0.52**			-0.70***	-0.21
			(0.29)	(0.26)			(0.22)	(0.21)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	342	342	342	342	324	324	324	324
r2	0.11	0.09	0.11	0.09	0.08	0.14	0.11	0.15

Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Note: For full results, see the appendix, Table A2. 11.

Finally, by comparison to those in the same gender group with moderate AG, we find a statistically significant effect of the AG on time discounting only for females with narrow AG (Table 2.23, columns 2). When the AG is measured as a continuous variable, we find evidence of a statistically significant effect of the AG on the time preferences (or impatience) of females (Table 2.23, column 1). In general, the lack of robustness of the results perhaps implies that there is very little effect of the aspirations-gap on time discounting.

Table 2.23. The effect of aspirations-gap on time discounting across gender

	Female		Male	
	(1) DisFactF1	(2) DisFactF2	(3) DisFactM1	(4) DisFactM2
Asp.Gap index	0.48*		0.19	
	(0.27)		(0.24)	
Squ.of Asp.Gap index	-0.01		-0.06***	
	(0.03)		(0.02)	
Wide Asp.Gap		0.61		0.18
		(0.50)		(0.36)
Narrow Asp.Gap		0.63*		-0.16
		(0.32)		(0.29)
Risk (composite index)	0.10**	0.05	-0.04	0.01
	(0.05)	(0.04)	(0.05)	(0.04)
Risk ×Asp.Gap	-0.06*	0.01	0.03	-0.02
	(0.04)	(0.02)	(0.02)	(0.01)
Other controls	Yes	Yes	Yes	Yes
Observations	342	342	324	324
r2	0.12	0.12	0.10	0.07

Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Note: For full results, see the appendix, Table A2. 12.

2.5.5. Robustness check

The OLS results reported in the preceding section (Table 2.19 to Table 2.23) may suffer from an endogeneity bias of some sort. Since it is difficult to find instrumental variables that might affect aspirations but not risk or time preferences for all are "internal" factors, we test the robustness of these results using a combination of matching estimators which are widely used in impact studies. Matching methods calculate treatment effects by comparing the outcomes of the treatment and control observations conditional on observed covariates. Since the

data for this study is purely observational, we employ a modified definition of "treatment" and "control" status as explained next. According to Ray (2006), only a moderate aspirations-gap is conducive for forward-looking behavior by contrast to narrow or very-large aspirations-gap. In this context, moderate AG could be understood as some sort of "treatment" that affects future oriented behavior. Thus, we generate a dummy that sorts individuals into two groups based on their aspirations-gap. That is, people with moderate AG are considered "treated" while the remaining are considered "control". This procedure, however, is likely to non-randomly assign individuals between these two groups. This is because individuals' aspirations (and hence their AG) depend on their own circumstances including psychological factors which are unobserved and this may lead to selection bias.

To address the selection bias, several matching estimators are used in the literature (e.g. Rosenbaum & Rubin, 1983; Smith & Todd, 2005). Covariate matching, for example, is one that matches the treated and control units directly using observable characteristics. This method can yield unbiased estimates but it requires many variables, hence the curse of dimensionality (Davis et al, 2012). To minimize the bias that may stem from matching on multidimensional covariates, Abadie and Imbens (2011) developed a bias-corrected matching estimators. Alternatively, matching based on propensity scores[24] (i.e. propensity score matching, PSM) is the most common method that is used to minimize the selection bias and the dimensionality problem (Rosenbaum & Rubin, 1983). The technique matches the treatment and control groups using propensity scores, based on their observable covariates which affect both the "treatment" status (i.e. having moderate AG) and the outcomes being measured (e.g. indicators of risk or time preferences).

Once the "treated" and comparable "control" observations are matched either through covariates directly or through propensity scores, the average treatment effect on the treated (ATT) is estimated using the following equation:

$$\mathrm{ATT} = \mathrm{E}[\mathrm{y_i}(1) - \mathrm{y_i}(0)|\mathrm{t_i} = 1] = \mathrm{E}[\mathrm{y_i}(1)|\mathrm{t_i} = 1] - \mathrm{E}[\mathrm{y_i}(0)|\mathrm{t_i} = 1] \qquad (10)$$

Where $\mathrm{y_i}(1)$ and $\mathrm{y_i}(0)$ respectively denote the outcome of individual i in the state of "treatment" and without "treatment" (i.e. the counterfactual), and $\mathrm{t_i}$ denotes the "treatment" status.

The analysis in this section is based on the bias-corrected matching estimators and two PSM estimators - kernel matching (KM) and nearest neighbor matching (NN)[25]. In Kernel matching, treatment effects are measured by subtracting from each outcome observation in the treatment group a weighted average of outcomes in the comparison group. On the other hand, NN matches treated with control groups with the nearest propensity

[24] The principal scores, P(Xi), are calculated according to: *P(Xi)=E(DiXi)*, 0< P(Xi)<1 where Xi are a vector of covariates that determine the aspirations level as well as outcomes (e.g. risk or discount factor).

[25] The theoretical detail of these estimators are referred to Abadie and Imbens (2006, 2011) and Heckman et al (1997, 1998).

scores and it accounts for differences in the mean values of the treated and control (Abadie and Imbens 2006). Further, efficiency of NN matching improves as the number of matches increase. As a standard procedure, we conduct a balancing test to check if there is a significance difference in the means of observed covariates across "treatment" and "control" groups (see Table A2. 13 and Figure A 1). Balancing test results suggest that the two groups are not balanced only in terms of gender and the value of assets owned. This implies that the bias will persist unless comparison is made based on exact matches. Yet, better inference could also be made by comparing the results obtained from PSM estimators with those obtained from the bias corrected matching (or covariate matching) estimator which is robust to the bias observed in the data.

2.5.5.1. Aspirations-gap on risk and time preferences

All results presented in this section are the average treatment effects on the treated (ATT)[26]. Considering the full sample, results suggest that having a moderate aspirations-gap had a positive and statistically significant effect (ATT) on minimized risk aversion (or increased risk loving) (Table 2.24). This result is robust across the three measures of risk aversion (i.e. based on lottery, market price of maize, and the composite risk aversion index), and nearly in all the three matching methods. Referring to column 3, for example, the impact of having a moderate AG, as opposed to having a narrow or large AG, is the increase in risk aversion index by about (0.53/3.64) = 14.6 percent. This means that individuals with moderate AG have risk aversion that is (0.53/1.553) = 0.34 standard deviations less than those with narrow or large AG. The coefficients in this table are not directly comparable with those in the preceding section for they were defined differently (i.e. in the preceding section, the effect of having low AG and having large AG were looked at by comparison to having moderate AG). Yet, the overall results confirm the robustness of the findings that a moderate aspirations-gap indeed enhances risk taking (or minimized risk aversion) behavior.

In contrast, we do not find a statistically significant effects of having a moderate AG on the discount factor (or time preferences) using any of the three matching estimators (Table 2.25). This again is in line with the findings of the previous section that a moderate AG does not have a statistically significant influence on time discounting (or impatience).

Table 2.24. The effect of aspirations-gap on risk aversion (using matching estimators)

	Lottery			Market price			Composite index		
	(1) Kernel	(2) NN	(3) Bias-Corrected	(4) Kernel	(5) NN	(6) Bias-Corrected	(7) Kernel	(8) NN	(9) Bias-Corrected
ATT	0.60**	0.62***	0.53***	0.13	0.32*	0.34*	0.34	0.70*	0.85***
	(0.27)	(0.22)	(0.18)	(0.26)	(0.18)	(0.18)	(0.50)	(0.36)	(0.32)
Risk index		3.64			3.02			6.66	
%change	16.5	17	14.6	4.3	10.6	11.3	5.1	10.5	12.7
N	664	664	664	664	664	664	664	664	664

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

[26] Following (Abadie & Imbens, 2002), robust standard errors are generated using bootstrapping for the matching procedure matches control households to treatment households "with replacement." Further, the option of "common support" is imposed to restrict the matches in the common support region (i.e. the option imposes a common support by dropping treatment observations whose pscore is higher than the maximum or less than the minimum pscore of the controls).

Table 2.25. The effect of aspirations-gap on time discounting, (using matching estimators)

	(1) Kernel	(2) NN	(3) Bias-Corrected
ATT	-0.17	-0.13	-0.26
	(0.28)	(0.27)	(0.21)
N	664	664	664

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

2.5.5.2. Average treatment effects (ATT) across gender

Results for each gender group closely follow the overall results, that moderate AG has a positive and statistically significant effect on risk loving (or reduced risk aversion) behavior (Table 2.26 and Table 2.27). According to Table 2.26, column 3, for example, among females, having a moderate AG increases risk aversion index by 22 percent, according to the lottery based risk measure. This means that females with moderate AG have risk aversion that is (0.71/1.264) = 0.56 standard deviations less than females with narrow or large AG. Similarly, using the lottery based measure of risk aversion, the average treatment effect (or increased risk aversion index) among males with moderate AG is about 15 percent (Table 2.27, column 3). This means that males with moderate AG have risk aversion that is (0.57/1.784) = 0.32 standard deviations less than those with narrow or large AG. While the magnitude of the average treatment effect seems to differ across gender, results strongly confirm the robustness of the findings of the preceding section.

Lastly, results suggest that there is no statistically significant effect of having a moderate AG on time discounting for either sex groups (Table 2.28). Although the coefficient (Table 2.28, column 3) for the ATT seems to imply a presence of some statistically significant effect for females, the result is not robust, as in the preceding section.

Table 2.26. The effect of aspirations-gap on females risk aversion, (using matching estimators)

	Lottery			Market price			Composite index		
	(1) Kernel	(2) NN	(3) Bias-Corrected	(4) Kernel	(5) NN	(6) Bias-Corrected	(7) Kernel	(8) NN	(9) Bias-Corrected
ATT	0.56	0.64**	0.71**	0.97**	0.51	0.50*	0.89	1.17*	0.98*
	(0.56)	(0.31)	(0.30)	(0.45)	(0.35)	(0.27)	(0.79)	(0.63)	(0.53)
Risk index		3.3			3.03			6.32	
%change	17	19.4	21.5	32	16.8	16.5	14.1	18.5	15.5
N	329	329	341	329	329	341	329	329	341

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table 2.27. The effect of aspirations-gap on males risk aversion, (using matching estimators)

	Lottery			Market price			Composite index		
	(1) Kernel	(2) NN	(3) Bias-Corrected	(4) Kernel	(5) NN	(6) Bias-Corrected	(7) Kernel	(8) NN	(9) Bias-Corrected
ATT	0.48	0.59***	0.57**	0.33	0.30	0.17	1.25**	1.11***	0.78*
	(0.37)	(0.22)	(0.23)	(0.28)	(0.25)	(0.23)	(0.60)	(0.43)	(0.41)
Risk index		3.84			3.02			6.86	
%change	12.5	15.4	14.8	10.9	9.9	5.6	18.2	16.2	11.4
N	323	323	323	323	323	323	323	323	323

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Table 2.28. The effect of aspirations-gap on time discounting across gender, (using matching estimators)

	Female			Male		
	(1) Kernel	(2) NN	(3) Bias-Corrected	(4) Kernel	(5) NN	(6) Bias-Corrected
ATT	-0.91	-0.53	-0.56*	-0.16	0.11	-0.28
	(0.57)	(0.43)	(0.33)	(0.49)	(0.31)	(0.27)
N	329	329	341	323	323	323

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

2.6. Conclusions

Amartya Sen's (1981) essay on entitlements and deprivation is referred to as a breakthrough in the analysis of poverty and well-being outcomes, and it has inspired numerous related concepts. One of the recent additions in development economics that draw inspiration from Sen (1981) and related literatures in social psychology and other social sciences includes the analysis of individual behavior using the aspirations-failure framework as articulated by Ray (2006) building upon Appadurai (2004). In Ray's view, poverty stifles dreams and hence effort choices which may result in a self-sustaining trap of poverty and the failure of aspirations. Dalton et al. (2014) on the other hand theoretically show that while poverty stifles dreams, low aspirations are rather a consequence of poverty. In these theoretical literatures, social environment and social interactions are described central in the formation of aspirations.

This Chapter empirically examines two research questions. First, we test the social interactions effect on aspirations based on two definitions of reference groups. Since individuals identify, interact and compare themselves with others in their immediate cognitive window, we use social networks as a reference group, in the first step. However, the availability of information regarding the outcomes of other people, who may not be "very close", may allow individuals to include them in their reference group (or as a separate reference group). Thus, in the second step, we define village as a reference group for village may capture wider or multiple reference groups. In both definitions of reference groups, we examine the social interactions effect based on the average outcome of all people in the reference group, as well as based on the average outcome of only those who are doing relatively better. Further, we test the hypothesis using individual components of the four dimensions of aspirations as well as the aggregate aspirations index. If true, the evidence from the individual dimensions of aspirations would imply that aspirations are indeed formed by observing peers' outcomes. Similarly, the evidence from the aggregate aspirations index would imply additional source of aspirations for individuals tend to "conform" with others, as the social interactions literature suggests.

In general, results in this Chapter suggest that there is indeed a statistically strong social interactions effect on aspirations, confirming the theory that aspirations are socially determined. Yet, the magnitude of the coefficient estimates are larger and they are statistically stronger when the reference group we consider are only those who are relatively doing better. This, in Genicot and Ray (2014) terminology, is referred to as *upward looking aspirations*.

This is particularly true when the wider reference group (i.e. village) is considered. We find that, for example, a standard deviation increase in the average aspirations index in the village is associated with a 0.046 to 0.076 point increase in individual's aspirations index. This is a 0.075 to 0.124 standard deviations increase in aspirations. Further, we find that social network size is statistically significantly associated with aspirations, providing additional evidence that aspirations increase with the widening of the *aspirations window* (such as a reference group). In addition, results by gender suggest that the effect of social interactions is statistically significant only for females. In the light of the descriptive statistics, males may have aspirations windows wider than the village average and thus neither peers' observed outcomes nor interactions with peers at the village level may substantially affect their aspirations. Females, in contrast, have limited exposure to media and living and travelling experience outside their village. Thus, observations and having some form of social interactions at the village level may just compensate and broaden their aspirations windows and thus their aspirations.

Second, we examine the effect of aspirations on time and risk preferences. Based on several empirical strategies, we fail to find a robust and statistically significant effect of aspirations-gap (AG) on time discounting. In contrast, we find a robust evidence on the hypothesised non-linear effect of AG on risk behavior. For example, based on the specifications that define AG as a continuous variable, results suggest that a standard deviation increase in the AG index is associated with a 0.21 standard deviations reduction in risk aversion. The negative and statistically significant coefficient of the square term of the AG confirms the hypothesized non-linear effect of the AG on risk behavior. Alternatively, results suggest that individuals with narrow AG are associated with risk aversion that is 0.22 to 0.41 standard deviations higher than those with moderate AG. The corresponding risk aversion of those with large AG is 0.26 to 0.31 standard deviations higher than those with moderate AG. We tested the robustness of these findings using matching estimators; and, the overall results confirm that a moderate aspirations-gap indeed helps enhance risk taking (or helps relax risk aversion) behavior.

Based on these findings, we conclude that policies aimed at raising the aspirations of the poor or their "capacity to aspire" may benefit from social interactions, and hence any such efforts may use and invest on social networks and reap the corresponding multiplier effects. Further, strategies that empower women and particularly that help widen their aspirations windows may earn the highest impact for wider aspirations window may increase their aspirations-gap which may in turn relax their risk aversion. Policies in this regard would be justified not only for the commonly expected direct motivation effects of aspirations on future regarding behavior, but also for the indirect effect through their effect on risk aversion.

3. SOCIAL NETWORKS, AGRICULTURAL INNOVATIONS, AND FARM PRODUCTIVITY IN ETHIOPIA

Abstract

This Chapter examines the existence of social learning in agriculture in Ethiopia. We use a 'random matching within sample' technique to collect data on social networks and elicit details of the relationships and information exchange between network members, complementing the analysis with information on self-reported networks. We find that, while kinship or membership in certain groups, informal forms of insurance, or having frequent meetings with network members are all associated with a higher probability of forming an information link, none of these are correlated with observed innovative behavior such as the adoption of row-planting. This may suggest that behavior is more likely to be affected by the nature of information that passes through the network, rather than the number of information links. In support of this, we find that information links that exclusively involve discussions on farming or business matters are indeed associated with a higher likelihood of adopting row-planting. We use econometric strategies to isolate social learning from that of correlated and contextual effects. After controlling for factors that might otherwise generate spurious correlation, we find a strong evidence of network externalities in the adoption of row-planting techniques and also in farm productivity. Our results imply that extension services and other programs that promote agricultural innovations and seek yield improvement may benefit from social networks but they may be more effective if they identify the 'right' networks, that is, the ones that exclusively involve information exchange regarding agriculture. This further implies that investment in group formation, rather than simply using existing networks, may be a beneficial strategy.

Keywords: Social networks, innovations, row planting, agriculture, Ethiopia

3.1. Introduction

Eighty-two percent of the population in Ethiopia live in rural areas (World Bank, 2012), with the majority depending on agriculture or related activities for their livelihood, either directly or indirectly. Despite some improvements in agricultural production in recent years, the overall agricultural growth falls short of the rapid population growth and importing food (in the form of aid and to some extent commercial imports) has become an important component of food supply in the country with an equivalent of 6.4 percent of the national food production between 1996 and 2010 on average (Graham et al, 2012). Ethiopian agriculture is characterized by low productivity which is associated with low input usage (such as improved seed varieties and fertilizer), significant post-harvest loss, population pressure, poor farming practices, and land degradation, among others (Negatu, 2004; Rashid, et al., 2010; Yao, 1996).

Besides measures that would take population pressure off agriculture, potential remedies lie in the promotion of agricultural innovations to sustainably improve agricultural productivity whilst increasing the efficiency of smallholder agriculture. Risk aversion (Yesuf and Bluffstone, 2009; Yu and Nin-pratt, 2014), perceptions about new technologies (Negatu and Parikh, 1999), access to extension and advisory services (Ragasa et al., 2013; Yu

and Nin-Pratt, 2014), and access to credit (Bekele and Drake, 2003) have been identified as the major determinants of technology adoption in Ethiopia. Other socio-economic factors also identified in these articles include human capital, livestock holdings, land size and tenure security.

Although there is an extensive literature on the diffusion of innovations and its determinants, one of which is social interactions (Rogers, 1983; Feder et al., 1985; Feder and Umali, 1993; Foster and Rosenzweig, 2010), studies on Ethiopian agriculture largely ignore the role social networks play in technology adoption. Only a few studies (Wossen et al., 2013; Kassie et al., 2012; Dessie et al., 2012) investigate the effects of social networks for improved farming and natural resource management practices. Evidence from other countries, however, suggests that social networks play a central role in people's lives in so many ways including in shaping beliefs, preferences, and decisions (Jakson, 2011). There is, for example, evidence on the role of social networks on the diffusion of information, new products, and technologies (Jackson and Yariv, 2011), informal insurance and risk sharing (Fafchamps, 2011), and labor and credit networks for economic activities (Munshi, 2011).

This Chapter adds empirical evidence to the existing literature on the role of social networks for the adoption of agricultural innovations and farm productivity in rural Ethiopia. Specifically, we examine the determinants of information and learning links among farmers, and whether those information links and their structure affect the adoption of innovations, mainly row planting in this context. We also identify social externalities in the adoption of row-planting methods, and in yield improvement as explained next.

We choose row-planting as an indicator of innovative behavior for it is a recent practice in Ethiopian agriculture, which makes it convenient to test the existence and role of social learning in technology adoption. Recent studies conducted in Ethiopia show that yields are very responsive to this improved practice. By comparison to the conventional broadcasting technique, for example, Alemu et al. (2014) find an average of 14.6 percent higher wheat yields with row-planting, while Vandercasteelen et al. (2014) find an increase in *teff* yields between 12 and 13 percent in farmers' experimental plots and 22 percent in demonstration plots managed by extension agents. Other on-the-field experimental trials in the country, however, report a more significant yield increase (for example, about 70 percent increase in teff yields (ATA, 2013)) that encouraged the country's extension system to up-scale the promotion of this agronomic practice in 2013. As is the case for other agricultural innovations, diffusion of this innovation requires farmers to experiment by themselves and also to learn from others before fully adopting the technique. Because of the potential importance of adopting row-planting, we examine whether social learning with respect to the adoption of row-planting takes place and whether evidence for an effect on yields exists.

The remainder of this Chapter is organized as follows: the next section presents the background to this study, reviews the literature our study relates to, and sets the conceptual framework of the paper. Section 3.3. presents the data we use, including descriptive statistics. The empirical strategy and results are discussed in Section 3.4. Section 3.5 concludes the Chapter.

3.2. Background and conceptual framework

There is little doubt about how central a role innovations can play for development. Yet, existing literature suggests that innovations, particularly in poor countries, are constrained by lack of information and market inefficiencies such as the absence of well-functioning credit and insurance markets. Networks may provide practical solutions in such circumstances and can guide policy decisions such as targeting. To be specific, social networks facilitate interaction, which is a central part of the innovation systems framework that understands the capacity for continuous innovation as a function of linkages, working practices, and policies that promote knowledge flows and learning among all actors (Hall et al., 2006). The underlying idea is that wider knowledge and information are embodied in different actors and interaction among them enhances their innovation behavior and performance. Social networks are the channels for such interactions and for social learning to occur.

Conceptually, we mainly draw on the theory of innovation diffusion outlined in the early 1960s by Everett M. Rogers in this paper. According to Rogers (1983), innovation adoption is preceded by a process of knowing about the existence of an innovation, developing an interest and making a decision about adoption. Rogers reflects on the relevance of social networks within the two main elements of diffusion: communication channels and social structure. For example, while mass-media such as ICTs and related channels are considered as the most rapid and efficient means in creating knowledge of innovations, interpersonal channels are more effective in persuading an individual to adopt innovations (Rogers, 1983). This, according to Rogers, occurs because people depend mainly upon a subjective evaluation of an innovation that is conveyed to them from other individuals like themselves who have previously adopted the innovation. This may be the case because individuals believe that the other person has superior information and hence they may try to learn; or, simply because individuals want to imitate others for reasons related to conformism, jealousy, and paternalism (Manski, 2000); or because neighbors are subject to related unobserved shocks (Conley and Udry, 2010). Despite enormous challenges of identification, this essentially underscores a central role that social networks can play in the adoption of innovations.

A set of connections (edges) among a collection of individuals (nodes) represent a network through which information, money, goods or services flow (Maertens and Barrett, 2013). Social networks may facilitate knowledge externalities as interactions among network members influence individual behavior. This is partly because individuals update their beliefs for their behavior - aspirations and expectations - are shaped not only by their own past experience but also by experiences of others in their network (Ray, 2006). Hence, interaction among network members is necessary for observations and learning to occur.

However, the degree of knowledge spillovers depends on the structure of the network (Rogers, 1983). It determines who interacts with whom, but as the determinants of the structure can be strategic or not (e.g. like-mindedness), any observed behavioral change may or may not be a result of interconnectedness. As an example, some nodes in the network may act as "opinion leaders" and informally influence the attitudes of other individuals (Rogers, 1983) which may be a case of network effects, while in other instances factors that

determine the formation of links in the first place may also affect individuals' behavior or decisions (referred to as 'homophily' (Jackson, 2011)).

On the other hand, network effects also very much depend on the extent to which relationships are transitive, that is, "the extent to which if node i is linked to node j, and j is linked to k, then i is linked to k", (Jackson, 2011: p.527). According to Jackson (2011), the frequency with which such transitivity is present is referred to as clustering, and clustering impacts the extent to which connections reach out to new nodes and can thereby affect information transmission. This issue of transitivity could be particularly interesting to research in the context of male versus female networks among members of the same households, the spouses' network being assumed to display different frequencies than the husbands'.

The other important factor for social learning is network size measured by the number of individuals linked through the network. While the literature on labor or credit networks, for example, predicts that individuals with access to stronger networks should have superior outcomes, Munshi (2011) argues that selective entry into the network and endogenous network size (strength) might give rise to a spurious network effect.

The central idea of social learning in the empirical literature has evolved from that of having insignificant variation within a given village (e.g. Foster and Rosenzweig, 1995) to the concept of innovation systems which assumes heterogeneity among network members, for example with respect to their knowledge about technologies, and puts interactions at the center of innovation processes (Hall et al., 2006). Further, networks can be defined in different ways. Some empirical studies including Foster and Rosenzweig (1995), Munshi (2004), and Isham (2002) define networks based on membership to certain groups, such as village, which essentially imply that experience from all farmers in the group is relevant. This approach might also disregard the possibility of links or information flows outside the group that may be critical to the information circulated within the group, which is also referred to as "the strength of weak ties" (Granovetter, 1973).

Despite significant differences on definition and measurement of social networks, there is a growing evidence for learning externalities or network effects on the adoption of agricultural innovations, highlighting learning spillovers in terms of the rate of adoption of the innovation (Foster and Rosenzweig, 1995), the role of technology specificities in learning from neighbors (Munshi, 2004), or the impact of ethnicity and social affiliations on adoption rates (Isham, 2002).

More recent studies measure networks in more detailed and structured manner that could account for various channels of information flow (e.g. self-reported networks, family, religious groups, kinship in Bandiera and Rasul, 2006; Matuschke and Qaim, 2009; or van den Broeck and Dercon, 2011). With the exception of a few studies such as Conley and Udry (2010) and Maertens and Barrett (2013), much of the existing empirical literature relies on data which defines networks based on such group membership or on self-reported links. Yet, these network measures are criticized for the possibility of ignoring important links outside the group or sample and of suffering from unobserved heterogeneity which might influence both the formation of links and that of the variable of interest (Maertens and Barrett, 2013; Munshi, 2011; Santos and Barrett, 2008). According to

Maertens and Barrett (2013), 'random matching within sample' may help address some of these shortcomings and allow identification of endogenous (peer) effects separately from correlated and contextual effects.[27] The limitation with this technique, however, is that the number of information contacts in the sample is smaller than the farmer's actual number of information contacts (Conley and Udry, 2010) and may be missing a key contact from the defined network (Maertens and Barrett, 2013). Using random matching within sample, Conley and Udry (2010) find evidence of social learning among farmers in Ghana as the latter align their use of an innovative technique with successful farmers in the previous period.

Networks, however, do not necessarily encourage innovations. Network externalities may introduce free riding in experimentation and hence strategic delays of technology adoption since neighbors' and own experience could be substitutes (Bandiera and Rasul, 2006, Foster and Rosenzweig, 1995, Kremer and Miguel, 2007). To sum up, the existing literature, both theoretical and empirical, highlights the importance of social networks for innovations. Yet, interaction effects vary with network characteristics including the type of network, network structure, network size, the frequency of interactions among members, the transitivity of relationships, technology specificity, and individual heterogeneity. However, the identification of network effects is challenging as it requires finding the 'right' networks, and, even in this case may suffer from problems of identification due to omitted variables, due to homophily (Jackson, 2011), or because mean behavior in the group is itself determined by the behavior of group members. Manski (1993) defines the latter simultaneity bias as the 'reflection problem'.

Based on the existing literature, we investigate whether individuals belonging to the same group tend to behave similarly in terms of adopting row planting, a recent innovation in Ethiopian agriculture due to: 1) endogenous or peer effects, 2) exogenous or contextual effects, and 3) correlated effects, and test for effects on farm productivity. To overcome some of the problems related to identification discussed above, this study uses a random assignment of matches within the sample, and controls for the lagged outcomes of peers. To complement our results, we, furthermore, use self-reported ties as a second measure of social networks, also to see whether they can be an independent source of information, similarly to van den Broeck and Dercon (2011).

3.3. Data

3.3.1. Sampling and measurement issues

We conduct a household survey between January and March 2014 in Ethiopia, which builds upon an existing sample of agricultural households surveyed in 2006 and again in 2010 in Oromia region under an NGO project

[27] According to Manski (1993), endogenous, contextual and correlated effects, respectively, arise wherein the propensity of an individual to behave in some way varies with: the behavior of the group; the exogenous characteristics of the group; and, wherein individuals in the same group tend to behave similarly because they have similar individual characteristics or face similar institutional environments.

that promoted agricultural innovations and ended in 2010.[28] The baseline survey used a mix of purposive and random sampling procedures to select 390 households from three study sites (Aredo, et al. 2008). The primary sampling unit consisted of a pair of neighboring districts or *woredas* which were chosen based on the density of cultivation of the major crop and on the presence of active farmers' cooperatives. In the second stage, *kebeles* (sub-districts) with active farmers' cooperatives were purposively selected. Finally, using the number of participating households within a cooperative as the sampling frame, households were then randomly selected. The major crop and total sample size in each research site are summarized in Table 3.1.

Table 3.1. Geographical distribution of the sample

	Bakko-Siree (major crop: maize)		*Lume-Adaa* (major crop: teff)		*Hettosa-Tiyyo* (major crop: wheat)		Total
District	Bakko	Sibu Siree	Lume	Adaa	Hettosa	Tiyyo	
Sample size at baseline (2006/07)	65	65	65	65	65	65	390
Number of households	64	63	63	64	62	63	379

Our survey covered 379 households but some households rented out their land and others did not cultivate any one of the main crops (maize, wheat or teff) either in the present or previous production seasons. We exclude these from the subsequent analysis because of the need for complete data, also on lagged values of yields, which reduces the final sample size to 350 households. Nevertheless, since part of the data is at the individual level (separately for the household heads and their spouses if married), the sample size for the individual level analysis is 681.

3.3.2. Social networks

As noted before, early studies on networks define the latter based on membership to certain groups such as the village, clan or as otherwise determined by social and cultural characteristics. These definitions may ensure that networks are exogenously determined but they allow limited room for variation among households. More recent studies, on the other hand, rely on individual level links reported by the respondent either inside or out of a sample. While these more recent approaches may allow variations among individuals and households, they suffer from a truncation bias, especially if respondents are allowed to name only a certain number of links. To be specific, their true networks may be much wider or key nodes and important links may have been forgotten (Maertens and Barrett, 2013).

Our approach follows Maertens and Barrett (2013) and Conley and Udry (2010) to collect network data using a random matching within sample where each respondent is matched with six randomly drawn individuals (three male and three female ones) from the sample and the same village (or *kebele*). Conditional on knowing the match, we construct network measures by eliciting details of the relationship between the individual and the match, and

[28] The analysis in this paper mainly relies on the 2014 data as the variables of interest in this analysis (networks and row-planting) are missing in the preceding surveys. Yet, we make use of lagged values of some explanatory variables for identification.

combine this information with household level background characteristics. Since information flows occur not only between, but also within households (thereby highlighting the importance of transitivity in terms of information flow and clustering within networks) we match the household head and their spouse separately to six individuals each, with each of the six matches being randomly drawn from different households of the sample within the village.

Further, to complement the analysis and to minimize the chance of omitting a key network node due to the random matching within sample, we also ask each respondent for the four other individuals they know best and elicit details of their relationships. These four contacts per respondent, that is, a maximum of eight per household, may include both the ones whom the respondent mostly interacts with for information or business matters and those whom the respondent relies upon as an informal source of insurance. These self-reported links are left out from our estimation of network effects for technology adoption as we do not have the matches' background characteristics that are crucial for identification because self-reported links may come from outside the surveyed sample. Therefore, we solely use these self-reported links to estimate the determinants of information or learning links.

Before we move on to the econometric analysis, we briefly examine the characteristics of networks. Table 3.2 and Table 3.3 present gender disaggregated network characteristics from both self-reported networks and from networks elicited through random matching within sample, respectively. Out of the four network partners the respondents mention, the descriptive statistics in Table 3.2 suggest that a little over half of the links do not have family ties with the respondent. By comparison, male respondents quote a higher percentage of close relatives among their links. Yet, the descriptives also suggest that both male and female respondents identify network partners who are around their own age, who mainly reside in the same village, and have the same native language, religion, and gender as the respondent. Furthermore, almost all respondents claim that their network partners and themselves help each other in times of need (or provide each other with an informal type of insurance). In terms of occupation, male respondents are, on average, more likely to identify links who are mainly farmers; and they report having discussions on farming or business matters with their network partners more often than female respondents do.

The data presented in this paragraph seem to support the criticism against heavily relying on definitions of networks based on membership in a specific group and support our choice of using random matching within sample for the key analysis. For example, if we were to rely only on networks defined along kinship, we would likely end up using a radically smaller network and miss important links as more than half of the links the respondents mention do not also belong to the respondent's family. Similarly, relying on definitions of networks based on, for example, religion, area of residence, ethnicity, and others would result in the omission of important links as shown in Table 3.2.

Table 3.2. Characteristics of self-reported network connections by gender of the respondent

	Female	Male
Network connections	N=1392	N=1313
	Percent	Percent
Self-assessed relationship:		
• Close relative (binary)	23	38
• Distant relative (binary)	20	11
• No family link (binary)	57	51
Male (binary)	23	93
Similar age (binary, difference<=5 years)	35	32
Same village (binary)	89	84
Discussion of business/farming matters (binary)	63	87
Same mother tongue (binary)	92	93
Same religion (binary)	87	86
Same *iddir* (binary)	70	77
Farmer (binary)	51	84
Help each other when in need (binary)	98	99

Note: 350 female and 331 male respondents.

In Table 3.3, we find that female respondents know a smaller proportion of their randomly drawn matches than their male counterparts. To be specific, female respondents know 3.7, male respondents 4.4 individuals on average out of their six random matches. Of those matches known to the respondent, less than 13 percent are related to the respondent (by blood or by marriage) for both sexes, while significantly more male respondents report belonging to the same *iddir* as their match.[29] Female respondents are less likely to discuss farming and business matters with their matches than male respondents, but quote an equal share of their matches to help them in case of needs.

Table 3.3. Characteristics of network connections derived through random matching within sample by gender of the respondent

	Female	Male
Network connections	N=1288	N=1450
	Percent	Percent
Respondent knows the match (binary)	66	79
Conditional on knowing the match:		
Related by blood or marriage (binary)	10	12
Male (binary)	51	52
Discussion of business/farming matters (binary)	12	24
Same *iddir* (binary)	33	51
Help each other when in need (binary)	36	40
	Mean (Std. Dev.)	
Distance between households (in minutes walking)	21 (19)	21(20)
Average number of matches known by the respondent	3.68 (1.75)	4.38 (1.38)
Average number of matches known by the household	7.22 (2.78)	

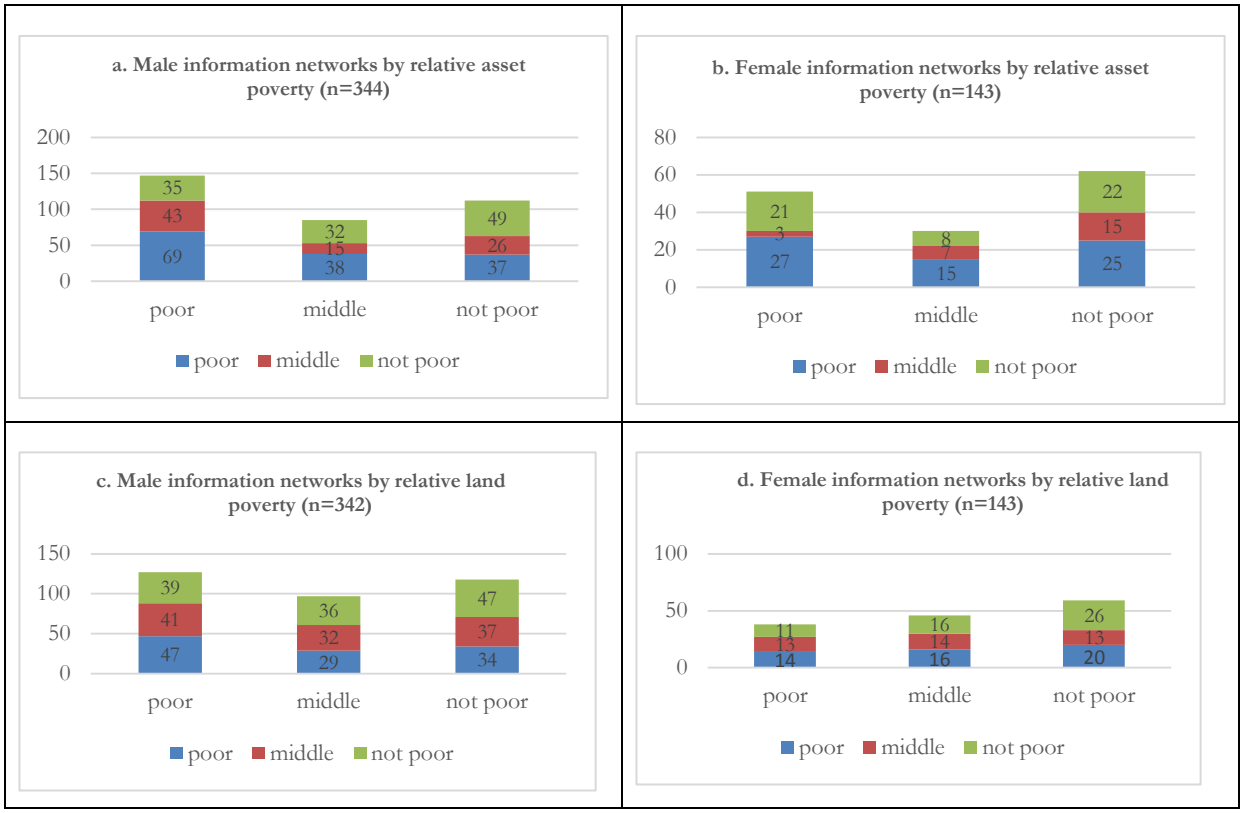
Note: 350 female and 331 male respondents.

Another way of looking at network characteristics and in particular the characteristics of matches is to group respondents and their matches based on their relative poverty standing as proxied by the value of their asset and

[29] An *iddir* is a community-based funeral organisation that is common in Ethiopia.

land holdings.[30] Since we expect that knowledge spillovers relating to agricultural innovations would come from networks that involve discussions regarding farming matters, we only consider network connections with whom respondents report having discussed farming and business matters. As shown in Figure 3.1, male respondents who are relatively poor along both asset- and land-based poverty measures are linked mainly to individuals who are also relatively poor. Similarly, those who are not poor are also connected mainly to individuals of a similar standing along both relative poverty measures. This pattern of interactions within social class is also evident for poor female respondents for both poverty measures, but all other classes (middle groups for males and females, non-poor class for females) show less clear interaction trends.

Figure 3.1. Network characteristics based on relative poverty measures



Lastly, it is worth noting from both self-reported and randomly allocated matches that, while both sexes are likely to similarly identify own links along gender, cultural or geographic lines, the nature of their relationships slightly diverge when asked whether they had discussed farming or business matters with the link. To be specific, the share of matches male respondents claim to have discussed farming or business matters with is twice the size female respondents report (Table 3.3). Yet, this should not be surprising: as men are generally perceived as decision-makers and involved in these activities in rural Ethiopia, which may have biased women to underestimate and underreport the significance of their own interactions. Another point that is apparent from

[30] Following Bandiera and Rasul (2006), we calculate relative poverty measures using two indicators: the size of own land holdings and the value of household assets including livestock. Hence, a household is considered: 'poor' (if the corresponding value is smaller than 75 percent of the sample average), 'middle' (if the value is between 75 percent and 125 percent of sample average), and 'not poor' (if the value is bigger than 125 percent of the sample average).

the descriptive statistics of the two types of networks is that there seems to be a lack of significant variation in the data when networks are measured based on self-reported links, which suggests endogenous network formation. As this is likely to complicate the identification of network effects, we rely on random matching within sample as described above.

3.3.3. Other descriptive statistics and variable definition

Table 3.4 presents a general overview of the socio-economic and demographic characteristics of the sample households. The data suggest that 10 percent of the households in the sample are female-headed, and the average age of the household heads is 50 years. Furthermore, about one third of household heads have not attended any schooling, while the average level of schooling attended by household heads is 4.6 years. Households in this sample appear to hold larger land holdings on average compared to the smallholder country average of about one hectare.[31] We report indicators of wealth such as the values of consumer durables and production assets in Ethiopian Birr (ETB) based on the respondents' own estimations.[32] We define household productivity as the value of all crops the household produced in a given production year divided by the hectare of farm land the household had access to. Using the official consumer price indices from 2006 to 2014, we deflate current market prices to 2006 constant prices as we will be making use of lagged values in subsequent analysis. The average livestock holding is 8.3 tropical livestock units and households are located around 20 minutes walking time to the nearest asphalt road or to the office of the agricultural extension agent. Other service centers such as markets, coop offices, input dealer shops, district towns and the nearest micro finance institution are all located in the range of 35 to 90 minutes walking time one way on average.

[31] Note, however, that, in terms of land holdings, households in the three study sites in general hold more land than the country average, also outside of our sample.

[32] The official exchange rate during the time of the survey was 1 USD=19 ETB according to the National Bank of Ethiopia (see http://www.nbe.gov.et/market/searchdollarcurrencies.html, accessed last February 9th, 2016).

Table 3.4. Descriptive statistics related to socio-economic characteristics (N=350)

Variable	Mean	Std. Dev.	Med	Min	Max
Sex of household head (1 if Female)	0.10	0.30		0	1
Age of household head (years)	50.4	13.3	50	25	88
Number of years of schooling completed by household head	4.62	4.10	4	0	16
Household size (number of household members)	6.76	2.36	7	1	16
Number of adult household members	3.66	1.57	4	0	8
Total land size owned by household (hectares)	2.21	1.40	2	0	8.25
Total current value of production assets (ETB)	5670	14723	1635	0	203765
Total current value of consumer durable assets (ETB)	7981	31803	2800	0	561950
Total livestock holdings (TLU)	8.23	5.23	7.6	0	35.05
Household treated in past NGO project (binary)	0.71	0.46	1	0	1
Household adopted row planting (binary)	0.63	0.48	1	0	1
Farm productivity 2014 (output/ha), value at 2006 prices	5071	6290	4234	2.11	85024
Farm productivity 2010 (output/ha), value at 2006 prices	3783	1983	3417	41	14551
Farm productivity 2006 (output/ha), value	3928	2457	3448	317	21917
Number of days listening to radio over the past year	220	143	206	0	365
Number of days watching television over the past year	133	151	48	0	365
Access to services/institutions (walking time in minutes)					
Distance to asphalt road	19.4	11.78	17	2	60
Distance to market	64.5	31.60	60	11	158
Distance to district town	93.3	37.66	93	20	185
Distance to coop office	35.2	17.08	34	4	98
Distance to input dealer	72.0	31.40	68	21	160
Distance to farmer training center (FTC)	23.2	11.41	20	7	78
Distance to micro-finance institution (MFI)	89.9	36.00	90	21	180

3.4. Empirical strategy and results

3.4.1. Empirical strategy

We analyze the role of networks in four parts. Firstly, we examine the determinants of learning links among farmers based on both the self-reported network connections and those that were allocated based on the random matching within sample. Next, we test whether network size and structure are correlated with the probability of adopting row planting. In the two remaining parts we then examine the effects of social learning on the likelihood of adopting an innovation (row planting in our case) and on average farm productivity.

We begin by defining that a 'learning link' or 'information link' exists if the respondent discussed farming or business matters with the network partner in the past 12 months. Following van den Broeck and Dercon (2011), De Weerdt (2002), and Fafchamps and Gubert (2007), we explore the determinants of information links in a dyadic regression framework where attributes z_i and z_j, for example, of network partners or nodes i and j enter regressions in differences, (z_i - z_j), and in sums, (z_i + z_j). For example, if z denotes age, then age enters the regression twice: fist as the difference between the ages of node i and node j, and simultaneously as the sum of the ages of the two nodes. According to Fafchamps and Gubert (2007), this approach allows capturing the effects of differences in attributes and also of the combined level effect of the attributes on the variable of interest, respectively.

Let the binary variable L_{ij} represent the existence of an information link between network nodes and take a value of one if node i discussed farming or business matters with node j and zero otherwise. A regression equation for the determination of a learning link can then be specified as:

$$L_{ij} = \alpha_0 + \alpha_1 w_{ij} + \alpha_2(z_i - z_j) + \alpha_3(z_i + z_j) + u_{ij} \quad , \qquad (1)$$

where w_{ij} captures attributes which do not vary between paired households such as geographic distance, z denotes other individual and household-level attributes that may determine the probability of a link between i and j, and u_{ij} is the error term. Since individuals that form networks and the networks of each node may have similar characteristics, the residuals are likely to be correlated. We allow for the error variances to be correlated through two-way clustering of the standard errors at the individual and at the match's level (Cameron et al., 2011 and Petersen, 2009).

To see whether an existing link and other characteristics that determine link formation are also correlated with observed behavior such as row planting, the following regression equation is estimated:

$$R_i = \alpha_0 + \alpha_1 L_{ij} + \alpha_2 w_{ij} + \alpha_3(z_i - z_j) + \alpha_4(z_i + z_j) + u_{ij} \quad , \qquad (2)$$

where R_i is an indicator variable that takes a value of one if farmer i adopts row planting and zero otherwise. L, w, and z are defined as before. Estimating equations 1 and 2 already helps us understand the nature of link formation and how links may be correlated with actual behavior but neither is able to identify a causal relationship between observed behavior such as the adoption of an innovation and network effects as link formation and own innovative behavior may both be driven by confounding factors.

Further, networks are mechanisms in which group behavior may influence individual behavior, and measuring network effects is tantamount to estimating neighborhood or peer effects, which is prone to simultaneity bias. As we recall from Section two, Manski (1993) refers to this as the "reflection problem" and hypothesizes that individuals belonging to the same group tend to behave similarly due to endogenous peer effects, exogenous or contextual effects, and correlated effects.[33] Since policy will have a social multiplier effect in the presence of endogenous effects (Manski, 1993), we identify endogenous effects separately from correlated and contextual effects. Hence, following Manski (1993), we employ the standard linear-in-means empirical model to estimate network effects, which can be specified as:

$$y_{ikt} = \beta \overline{y}_{-ikt} + \overline{x}_{-ikt}\gamma + x_{ikt}\lambda + \delta_j + \varepsilon_{ikt} \quad , \qquad (3)$$

where y_{ikt} denotes an outcome (the adoption of row planting or average farm productivity in our case) for individual i who belongs to network k at time t; $\overline{y}_{-ikt}$ denotes the average outcome of the peers excluding i at

[33] According to Manski (1993) endogenous, contextual and correlated effects arise when the propensity of an individual to behave in a specific way varies with the behavior of the group, the exogenous characteristics of the group, and when individuals in the same group tend to behave similarly because they have similar individual characteristics or face similar institutional environments, respectively.

time t; $\overline{x}_{-ikt}$ denotes the average value of the observable characteristics of peers excluding i; x_{ikt} denotes a vector of i's observable characteristics; δ_k denotes location fixed effects and controls for unobservable characteristics common to all network points in the village or district that may influence adoption or productivity; and ε_{ikt} is a time-variant unobserved component. $\beta \neq 0$, $\gamma \neq 0$, and $\delta \neq 0$ suggest the existence of endogenous-, contextual- and correlated effects, respectively, and λ denotes direct effects.

However, as it stands, equation (3) is unable to solve the reflection problem since the behavior of the individual also affects the mean behavior of their group or network. Hence, to improve identification we introduce dynamism to the model as suggested by Manski (2000) by replacing $\overline{y}_{-ikt}$ with its lagged value $\overline{y}_{-ikt-1}$of individual i's reference group (more on this in Section 3.4.2.3). We allow for differentiated effects by estimating equation (4) with a focus on the network connections of the household head, and on the connections of both the household head and the spouse combined.

$$y_{ikt} = \beta\overline{y}_{-ik,t-1} + \overline{x}_{-ikt}\gamma + x_{ikt}\lambda + \delta_k + \varepsilon_{ikt} \qquad (4)$$

3.4.2. Results and discussion

As pointed out in the preceding section, we present the analysis of econometric results in four parts. We first examine the determinants of a learning link in part 1 and we follow that up by analyzing whether network size and structure are actually correlated with the probability of adopting row-planting technique (part 2).[34] We identify social learning effects on the adoption of row-planting technique and average farm productivity in parts 3 and 4, respectively. All continuous variables excluding those which enter regressions in differences (or changes) are log-transformed.

3.4.2.1. Determinants of information links

As mentioned above, we define a link as an 'information' or a 'learning' link if the respondent had discussed farming or business matters with the match in the past twelve months prior to the survey. Table 3.5 and Table 3.6 present the marginal effects of Probit estimations of equation 1, that is, the determinants of whether a randomly allocated or self-reported link is an information link, respectively. We use a dyadic framework and estimate the relationship for household heads, male respondents, female respondents, or the latter two combined. To be specific, column 1 of Table 3.5 relates to all respondents combined regardless of gender and relationship of the respondent to the household head, while the results in columns 2 and 3 refer to male and female respondents, respectively. Column 4 and 5 are based on heads of households without and with the sums of certain control variables. Table 3.5 suggests that belonging to the same *iddir*, having blood ties, and having high frequency of meetings with the match all significantly increase the likelihood of a learning link regardless of the gender and whether the respondent is the household head or spouse. Other forms of network partnership such as being one that could be used in times of need also improves the likelihood of a learning link. These

[34] We find very little, if any, change of results when bootstrapping the standard errors in all estimations of Sections 3.4.2.1 and 3.4.2.2. Results not reported but available upon request.

results also hold for self-reported networks (Table 3.6) except that belonging to same *iddir* appears to improve the likelihood of a learning link only for female respondents while having an insurance partner seems to be important only for male respondents.

Table 3.5. Determinants of learning links (using random matching within network data), marginal effects of a Probit estimation‡

(Dependent variable: 1 if i discusses farming or business matters with j, 0 otherwise)

	ALL		MALE		FEMALE		HH HEAD		HH HEAD	
	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
Same ethnicity+	0.01	0.02	-0.01	0.04	0.01	0.03	0.01	0.04	0.00	0.04
Same religion+	0.01	0.02	0.05	0.03	0.00	0.02	0.03	0.03	0.03	0.03
Same iddir+	0.08 ***	0.02	0.06 *	0.03	0.06 **	0.03	0.08 **	0.03	0.07 **	0.03
Help when in need+	0.15 ***	0.03	0.17 ***	0.04	0.11 ***	0.03	0.18 ***	0.04	0.17 ***	0.04
Related(blood/marriage)+	0.14 ***	0.04	0.15***	0.06	0.13 ***	0.04	0.15 ***	0.06	0.14 ***	0.06
Meeting frequency	0.00 ***	0.00	0.00 ***	0.00	0.00	0.00	0.00 ***	0.00	0.00 ***	0.00
Geo.dist.(i,j)(ln)	-0.02 **	0.01	-0.04 **	0.02	-0.02	0.01	-0.03	0.02	-0.03	0.02
Having plots nearby+	0.03	0.03	0.05	0.06	-0.01	0.03	0.09*	0.06	0.06	0.05
Radio list.(freq)	0.00	0.00	0.00 ***	0.00	0.00 *	0.00	0.00 ***	0.00	0.00 ***	0.00
Tv watch.(freq)	0.00 ***	0.00	0.00 **	0.00	0.00 **	0.00	0.00 **	0.00	0.00 **	0.00
Travel to town.(freq)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diff. gender dummies	-0.03	0.02	-0.24 ***	0.03	-0.03	0.02	-0.2 ***	0.03	-0.1 ***	0.04
Diff. of age (i,j)	0.00 ***	0.00	0.00 *	0.00	0.00 ***	0.00	0.00	0.00	0.00	0.00
Diff. educ (i,j)	0.00	0.00	0.00	0.00	0.01 **	0.00	0.00	0.00	0.00	0.00
Diff. HH size (i,j)	0.00	0.01	0.01	0.01	-0.01	0.01	0.00	0.01	0.00	0.01
Diff. no. of men	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Diff. land size	-0.01*	0.01	-0.02*	0.01	0.00	0.01	-0.01	0.01	-0.01	0.01
Diff. treatment status	0.02	0.02	0.02	0.03	0.01	0.02	0.01	0.02	0.02	0.03
Sum gender dummies	0.10 ***	0.02	0.00	-		-			0.12 ***	0.04
Sum of age (i,j)	0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00
Sum of educ (i,j)	0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00
Sum of HH size (i,j)	0.00	0.00	0.00	0.01	0.00	0.00			0.00	0.01
Sum no. of men	0.00	0.01	0.00	0.01	0.00	0.01			0.00	0.01
Sum of land size	0.01	0.01	0.01	0.01	0.00	0.01			0.01	0.01
Sum treatment status	0.02	0.02	0.04	0.02	0.01	0.02			0.04*	0.02
Hitossa-Tiyo+	0.01	0.03	0.02	0.05	-0.02	0.03	0.01	0.05	0.05	0.05
Adaa-Lume+	0.02	0.03	-0.02	0.05	0.01	0.03	-0.03	0.04	-0.02	0.05
Observations	2339		1285		1054		1402		1402	
Log lik.	-878.6		-530.6		-302.7		-601.3		-584.7	
Pseudo R2	0.24		0.27		0.22		0.24		0.26	

+Note: dy/dx for factor levels is the discrete change from the base level. Other covariates fixed at their means.
‡Probit coefficients are reported in the appendix in Table A3. 1.

The age difference variable is positive and statistically significant in Table 3.5 ((columns (2) and (3)) for both male and female respondents implying that younger people are more likely to mention older ones as their learning link. This is in contrast with the results from self-reported links (Table 3.6), which suggest that the likelihood of a learning link is higher within age groups. Gender of the network partner does not seem to be an important factor for the establishment of a learning link for female respondents, while the existence of a learning link with opposite sex seems less likely for male respondents and male household heads (Table 3.5). Yet, there seems to be a level effect on learning links across same gender and it is especially the case among male household heads. This again is also in line with results from self-reported networks (Table 3.6) which suggest that having a network partner of the same gender improves the likelihood of a learning link for both female and male respondents.

Table 3.6. Determinants of learning links (using self-reported networks), marginal effects of a Probit estimation‡

(Dependent variable: 1 if i discusses farming or business matters with j, 0 otherwise)

	ALL		MALE		FEMALE		HH HEAD	
	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
Same ethnicity	0.02	0.05	-0.01	0.04	0.02	0.09	0.02	0.05
Same religion	-0.04	0.04	0.02	0.03	-0.10*	0.06	0.00	0.03
Same iddir	0.11***	0.04	-0.01	0.03	0.14***	0.05	0.02	0.03
Close family	0.13***	0.03	0.06**	0.02	0.16***	0.05	0.07***	0.03
Distant family	0.10***	0.03	0.05**	0.03	0.16***	0.05	0.07***	0.02
Same village	0.01	0.06	0.12	0.07	-0.08	0.10	0.09	0.07
Same kebele	-0.01	0.08	0.05	0.03	-0.07	0.14	0.05	0.04
Same gender	0.22***	0.04	0.11**	0.05	0.15**	0.06	0.11***	0.04
Same age	0.07***	0.02	0.03	0.02	0.09**	0.04	0.04**	0.02
Farmer	0.20***	0.03	0.22***	0.06	0.09*	0.05	0.23***	0.05
Meet less than 1/week	0.20***	0.06	0.15*	0.07	0.17**	0.08	0.15**	0.07
Help when in need	0.11	0.12	0.26	0.18	0.01	0.14	0.36**	0.17
Max of age from i & j‡	0.00*	0.00	0.00*	0.00	0.00	0.00	0.00*	0.00
Education 0-4(dummy)	0.05	0.04	0.05	0.03	-0.02	0.07	0.07**	0.03
Education 5-8(dummy)	0.03	0.04	-0.02	0.04	-0.06	0.08	0.00	0.04
Education 8+(dummy)	0.06	0.05	-0.04	0.05	0.05	0.09	-0.01	0.05
Radio list.(freq)‡	4.8E-05	9.2E-05	8.5E-05	8.3E-05	-2.0E-04	1.5E-04	2.4E-05	8.4E-05
Tv watch.(freq)‡	2.0E-04	1.3E-04	1.1E-04	9.8E-05	3.3E-04*	1.9E-04	4.1E-05	1.0E-04
Travel to town.(freq)‡	4.7E-04**	2.3E-04	1.3E-04	1.3E-04	1.0E-03	6.3E-04	2.0E-04	1.5E-04
Land size (ha) (ln)‡	0.02**	0.01	0.02**	0.01	0.02	0.02	0.02**	0.01
Hitossa-Tiyo (dummy)	-0.07	0.05	0.01	0.04	-0.10	0.08	0.02	0.04
Adaa-Lume (dummy)	-0.11**	0.05	0.03	0.03	-0.23***	0.07	0.03	0.03
Observations	2565		1270		1295		1400	
Log lik.	-1233.5		-362.57		-772.19		-436.3	
Pseudo R2	0.1465		0.258		0.0956		0.2401	

‡These covariates are fixed at their means. dy/dx for factor levels is the discrete change from the base level. ‡Probit coefficients are reported in the appendix in Table A3. 2.

Contrary to expectations, other socio-economic indicators such as education, household size, and the size of land holdings seem to be less important for the likelihood of learning links. In addition, while evidence suggests that living near the match tends to only weakly improve the likelihood of learning links among male respondents, the location of residence in relation to the network partner does not appear to be important in general and for self-reported networks in particular. Rather, having a network partner who is also a farmer increases the likelihood of a learning link in self-reported networks. These results therefore suggest that our findings are not only driven by correlated and contextual effects, and hence endogenous formation of networks seems to be of less a concern in this specific case.

Further, since it is essential to control for all potential sources of information in estimations of 'learning links' (Matuschke and Qaim, 2009; Maertens and Barrett, 2013), we do so by accounting for the frequency of travel the respondent makes to the nearest town and the frequency that the respondent listens to the radio and watches television. We proxy for other information sources such as extension services, markets, and also other fixed effects by controlling for district dummies. Our results suggest that frequently following mass-media such as radio and television facilitates the chance of a learning link but only from estimations using networks from the 'random matching'-exercise. The frequency of travel to nearest town does not appear to be important in the probability of a learning link at individual level analysis in both methods of sampling networks. Yet, the frequency of travel matters at the household level for self-reported networks. Finally, the results do not

qualitatively change when we include indicators for smaller geographic units (such as *kebele*) instead of district dummies.

3.4.2.2. The effect of social network size and structure on the probability of adopting row planting

In this section we directly examine whether learning links are correlated with innovation behavior. We start by noting that our data do not suggest that spouses individually hold farms and hence we assume that the adoption of an innovation is a household-level decision, represented by the behavior of the household head. Thus, unlike the investigation of determinants of learning links at the individual level, we conduct household-level analyses in this and the subsequent sections. Marginal effects of Probit estimation from a dyadic regression framework as outlined in equation 2 relating the adoption of row planting to the characteristics of the household head, the match and the nature of their relationship, and other controls are presented in Table 3.7, conditional on knowing the randomly allocated match. We specify the nature of the link between nodes, which may involve advice; informal insurance; kinship; belongingness to same *iddir*, ethnicity or religion; frequency of meetings between the two; the distance between the households; and whether they hold adjacent plots.

Table 3.7. The effect of social network structure on the probability of adopting row planting, marginal effects of a Probit estimation‡

(Dependent variable: 1 if i adopts row planting, 0 otherwise)

	Household head 1		Household head 1	
	dy/dx	Std. Err.	dy/dx	Std. Err.
Discussion on farming/business+	0.066**	0.028	0.059**	0.028
Help when in need+	-0.053	0.028	-0.044	0.028
Related(blood/marriage)+	-0.018*	0.042	-0.018	0.041
Meeting frequency	0.000	0.000	0.000	0.000
Geo.dist.(i,j)(ln)	-0.041**	0.017	-0.036**	0.017
Having plots nearby+	0.011	0.047	0.018	0.046
Radio list.(freq)	0.000	0.000	0.000	0.000
Tv watch.(freq)	0.000***	0.000	0.000***	0.000
Travel to town.(freq)	-0.001***	0.000	-0.001***	0.000
Diff. gender dummies	0.014	0.026	0.012	0.026
Diff. of age (i,j)	-0.002*	0.001	-0.001	0.001
Diff. educ (i,j)	0.001	0.003	0.001	0.003
Diff. no. of men	0.006	0.006	0.006	0.006
Diff. land size	0.051***	0.008	0.053***	0.008
Diff. treatment status	0.041**	0.018	0.034*	0.018
Sum gender dummies	-0.051*	0.027	-0.048*	0.026
Sum of age (i,j)	0.000	0.001	-0.001	0.001
Sum of educ (i,j)	0.004	0.003	0.004	0.003
Sum no. of men	0.008	0.006	0.008	0.006
Sum of land size	0.039***	0.008	0.041***	0.008
Sum treatment status	0.063***	0.019	0.064***	0.019
Same ethnicity+	0.027	0.030	0.013	0.029
Same religion+	0.039	0.033	0.024	0.032
Same iddir+	0.016	0.028	0.027	0.028
Dist. asphalt road (minutes)(ln)			0.001	0.001
Dist. market (minutes)(ln)			0.000	0.000
Dist. district (minutes)(ln)			0.000	0.001
Dist. coop office (minutes)(ln)			0.000	0.000
Dist. input dealer (minutes)(ln)			0.000	0.000
Dist. FTC (minutes)(ln)			0.000	0.001
Dist. MFI (minutes)(ln)			-0.001*	0.001
Hitossa-Tiyo+	-0.699***	0.037	-0.669***	0.042
Adaa-Lume+	-0.849***	0.026	-0.804***	0.036
Observations	1402		1404	
Log lik.	-567.8		-557.9	
Pseudo R2	0.37		0.38	

+Note: dy/dx for factor levels is the discrete change from the base level. Other covariates fixed at their means.
‡Probit coefficients are reported in the appendix in Table A3. 3.

Table 3.7, column 1, shows that the 'advice link'- *having discussed farming or business matters with the network partner*- is statistically significantly associated with the likelihood of adopting row planting. Perhaps this might be indicative of suggestive evidence of learning externalities, which we formally test in the next part. While the statistical significance of the variable for the distance between households may cast doubt on the existence of correlated behaviors, other potential network indicators such as kinship, belonging to same *iddir*, ethnicity or religion, having plots next to each other, are not statistically significantly associated with the probability of adopting this innovation. Further, in addition to indicators for mass media such as radio and television, the results remain robust in column 2 after controlling for more potential sources of information and extension services proxied by average distance between farmer's residence and offices of the extension agent, cooperative offices, input dealer shops, nearest markets, nearest micro-finance institutions, district towns, and nearest asphalt road. Surprisingly, none of these additional sources of information and other services appear to be strongly associated with the probability of adopting row planting.

Watching television more frequently appears to affect the probability of adopting row planting positively and statistically significantly. This may show the power of visual aids in convincing farmers more strongly than other sources of information specified in this study and may be in line with Bernard et al. (2015) who establish the effectiveness of video-based interventions in inducing behavioral changes in rural Ethiopia. Surprisingly, however, making more frequent travels to the nearest town seems to negatively affect the likelihood of adopting this innovation. This may be because the cost of receiving new information and knowledge from such travels outweighs the potential benefits because row planting is currently still perceived as a labor-intensive practice in Ethiopia and making frequent travels to towns may just induce a trade-off between the required labor supply and the chance of receiving new information. Although it is beyond the scope of this paper, this could potentially be investigated by testing the separability of household labor supply and demand.

Moving on to other results, the sum and difference in land holdings between the farmer and the match are both positive and statistically significant, thereby implying that innovation adoption is more likely among networks with both large and small farmers. This is in line with expectations as the size of land holdings is a very good predictor of wealth in rural Ethiopia, and as farmers with more wealth are likely to experiment with new innovations, which may create the possibility of knowledge spillovers to smaller farmers in their network. Our results also suggest that farmers having more links with farmers of similar age are more likely to adopt the new technology. The result, however, is only weakly statistically significant and not robust to different specification. In contrast, the variable that represents the sum of male dummy is negative and significant implying that links with more male household heads are less likely to adopt row planting. This is less intuitive, however, because having many male network connections may mean more learning links as we find in the previous section. Yet, we cannot rule out the fact that the results may present evidence of strategic delays in the adoption of this innovation when there are many male links in one's networks.

On the other hand, variables that represent the sum and difference of farmers who were treated by an NGO project in the past are both positive and statistically significant.[35] This implies that non-treated farmers who are linked with past project beneficiaries are more likely to adopt row planting, which is in line with expectations as the NGO project promoted related agricultural innovations and farmers may learn from others. In summary, having controlled for many factors that could proxy for correlated behavior within networks, the results in this section suggest that learning from network connections exists among the study households, which we formally test in the next section.

3.4.2.3. The effect of networks on technology adoption

We noted in Section 2 that the identification of social network effects is complicated due to the presence of omitted variables and simultaneity. Our rich dataset allows us to effectively control for factors that may otherwise generate spurious correlation. To correct for the reflection problem, Manski (2000) suggests to introduce dynamism to the model and to relate individual behavior to lagged rather than contemporaneous values of group mean behavior. An alternative approach Manski suggests is to use instrumental variables that directly affect the outcomes of some, but not all group members. The latter is equivalent to Angrist and Pischke's (2009, p.196) suggestion to use "some measure of peer quality which predates the outcome variable and is therefore unaffected by common shocks." We fit equation 4 using a slightly modified combination of the two options as explained next.

Row planting is a recent innovation in Ethiopia and our data were collected in 2006 and again in 2010 long before this innovation was promoted in 2012/13. Therefore, we expect that lagged indicators such as farm productivity measured as output per hectare from the baseline period to be unaffected by present common shocks or the new innovation (or row planting). In addition, only some of the study households were treated by an NGO project during the baseline period (2006-2010) and, again, we do not expect that the new innovation would affect their past treatment status. On the contrary, we expect that both past productivity levels and past treatment status would affect a farmer's present innovation behavior. Our data refer to the production years 2006/07, 2009/10 and 2013/14 and since this innovation was promoted half-way between the second and third data points (and that innovation adoption being a rather slow process) we believe that we have a reasonable lag length, not to mention availability of the data as such. Our two identifying variables are therefore the change in productivity between 2006/07 and 2009/10 and past treatment status of the farmer and their peers. We choose the change in productivity rather than levels because doing so helps to control for time-invariant characteristics as well as it would reflect past trend in the innovation behavior of farmers, which is likely to be correlated to present ones. Further, we use various specifications and the change in productivity between 2013/14 and 2009/10 as identifying variables for a robustness check.

[35] The NGO project promoted various agricultural technologies and practices (such as improved varieties and improved natural resource management practices excluding row planting). The project was terminated before the data in 2010 were collected.

Table 3.8 and Table 3.9 present results that identify endogenous (network) effects separately from correlated and contextual effects. In both tables, columns 1 and 2 report results using networks from only the household head, while columns 3 and 4 are based on networks from both the spouse and the household head combined. Results clearly indicate that there is strong evidence of network externalities in the adoption of row planting in the study areas. For example, the results in column 1 of Table 3.8 suggest that the average change in peers' productivity between 2009/10 and 2006/07 is strongly associated with the probability of a farmer adopting row planting. This result is even stronger when we use the wider network, i.e. combined networks from both spouses (columns 3 and 4), which may be interpreted as evidence of transitivity of relationship or clustering among networks as described above. Furthermore, the number of treated individuals in one's network statistically significantly increases the probability of adopting row planting (columns 1 and 3). This evidence of endogenous effect is present even after controlling for own past treatment status.

Table 3.8. The effect of social learning on the adoption of row planting, marginal effects of a Probit estimation‡

(Dependent variable: 1 if i adopts row planting, 0 otherwise)

	Networks of the household head				Networks of both spouses			
	dy/dx	Std. Err	dy/dx	Std. Err	dy/dx	Std. Err	dy/dx	Std. Err
Average value of peers' characteristics								
Change in ave. yield (2006-2010)	4E-05*	2E-05	2.1E-05	2E-05	8E-05***	3E-05	5.3E-05**	2.6E-05
Share of treated	0.19*	0.12	0.13	0.11	-0.12*	0.20	-0.26	0.18
Ave. age(years)(ln)	0.12	0.17	0.10	0.16	0.21	0.24	-0.02	0.23
Ave. HH size(ln)	0.05	0.20	0.04	0.19	0.07	0.04	0.05	0.04
Ave. value of prod. assets(ln)	0.04	0.03	0.02	0.03	0.01	0.04	-0.04	0.04
Ave. value of cons. durables(ln)	0.02	0.03	0.01	0.03	0.08	0.14	0.15	0.12
Ave. livestock holdings(TLU)(ln)	0.03	0.12	0.01	0.10	-0.14	0.11	-0.03	0.10
Ave. landholdings(ha)(ln)	-0.02	0.10	0.01	0.10	0.24	0.13	0.09	0.12
Household characteristics								
Female HH head+	0.02	0.08	0.01	0.08	0.03	0.08	0.03	0.07
Age of HH head (years)	-0.01	0.01	-0.01	0.01	-0.01	0.01	-0.01	0.01
Square. of age of HH head	8.7E-05	0.0001	6.9E-05	1E-04	5E-05	1E-04	3.5E-05	1.1E-04
Education 0-4(dummy)+	-0.02	0.08	-0.04	0.08	0.00	0.08	0.00	0.07
Education 5-8(dummy)+	0.11	0.07	0.09	0.06	0.11*	0.06	0.09	0.05
Education 8+(dummy)+	0.07	0.08	0.07	0.07	0.07	0.07	0.08	0.06
Radio list.(freq)	1.5E-04	2E-04	1.5E-04	2E-04	5E-05	2E-04	4.1E-05	1.6E-04
Tv watch.(freq)	0.00**	0.00	0.00**	0.00	0.00***	0.00	0.00**	0.00
Nonfarm/business activities+	-0.02	0.07	-0.04	0.06	-0.02	0.06	-0.06	0.06
HH size (ln)	0.00	0.08	0.00	0.08	0.01	0.08	0.00	0.07
Size of own land (ha)(ln)	0.18***	0.05	0.18***	0.05	0.18***	0.05	0.17***	0.04
Treated+	0.18***	0.07	0.15**	0.06	0.17***	0.06	0.14***	0.06
Dist. asphalt road (minutes)(ln)			0.07	0.06			0.08	0.07
Dist. market (minutes)(ln)			-0.09	0.07			-0.16	0.08
Dist. district (minutes)(ln)			-0.04	0.28			0.90	0.39
Dist. coop office (minutes)(ln)			-0.02	0.05			-0.08	0.06
Dist. input dealer (minutes)(ln)			0.00	0.08			0.01	0.10
Dist. FTC (minutes)(ln)			-0.03	0.06			0.09	0.07
Dist. MFI (minutes)(ln)			-0.23	0.28			-1.24	0.40
Hitossa-Tiyo+	-0.7***	0.10	-0.7***	0.10	-0.6***	0.11	-0.5***	0.14
Adaa-Lume+	-0.96***	0.10	-0.7***	0.10	-0.9***	0.11	-0.6***	0.16
Observations	346		346		348		348	
Log lik.	-140.1		-135.3		-137.3		-129.5	
Pseudo R2	0.39		0.41		0.40		0.45	

+Note: dy/dx for factor levels is the discrete change from the base level. Other covariates fixed at their means. ‡Probit coefficients are reported in the appendix in Table A3. 4.

None of peers' exogenous characteristics including age, household size, the value of production assets, the value of consumer durables, livestock holdings, and land size holdings are statistically significantly associated with a farmer's probability of adopting row planting, which suggests the absence of contextual effects, i.e. farmer's innovation behavior is not correlated with the exogenous characteristics of their reference group.

We control for correlated effects using district dummies. By comparison to the Bakko-Sire study site, it appears that farmers in Lume-Adda and Hitossa-Tiyo are less likely to adopt row planting. This does not come as a surprise as, among many other factors, the main crop in the reference study site is maize, whose agronomic management is less labor demanding, when using the existing practice, by comparison to *teff* and wheat, which are the main crops in the other two study sites.

Most of the individual and household-level characteristics such as gender, age and religion of the household head, and household size do not appear to be strongly associated with the probability of adopting row planting. Farmers with primary education seem to be more likely to adopt row planting compared to those with no education. Having a larger land size is also strongly associated with the likelihood of adopting row planting. We also control for potential sources of information and extension services including radio, television and other proxy variables such as the average distance between the farmer's residence and offices of the extension agent, cooperative offices, input dealer shops, the nearest market, the nearest micro-finance institution, district town, and the nearest asphalt road. We find that farmers who frequently watch television are more likely to adopt row planting, which is in line with expectations and our findings in the preceding section on the correlates of adopting row planting.

Similarly, our results suggest that farmers who are located further away from services such as markets and micro-finance institution are less likely to adopt row planting. Another result which seems less intuitive is that those who reside closer to district towns are less likely to adopt row planting. This could be because these farmers may tend to frequently travel to towns and doing so may leave them little time to adopt this labor-intensive technique. Nevertheless, the coefficient on the dummy that represents whether any of the household members engages in other income-generating activities is negative but not statistically significant. This indicator variable may be a poor proxy for picking up the effect of making frequent travels and engagement in non-farm activities and testing for separability of household labor supply and demand might help, but it is beyond the scope of this paper.

Robustness check

As mentioned above, we also use the average change in peers' average productivity between 2009/10 and 2013/14 as identifying variables for a robustness check of our findings on the existence of social learning. All other controls are the same as before. We find that the coefficient for the change in peers' average productivity between 2009/10 and 2013/14 is negative and statistically significant (Table 3.9). This again is evidence of network externalities but of the opposite sign. We propose two possible reasons for the negative sign. First, the peers' contemporaneous data (2013/14 data) is being used to calculate the change in productivity and doing so may not properly satisfy the requirements of using a lagged value as an identifying variable. Secondly, we note in the descriptive statistics that the average change in peers' average productivity between 2009/10 and 2013/14 is positive while the change between 2006/07 and 2009/10 of the same indicator is negative. Our interpretation is

that, when farmers observe a decline in average productivity of the reference group, individual farmers may tend to improve their own productivity by doing something different or by employing a new technology while they otherwise could stick to their old practice if everybody else is doing well. In any case, our results suggest that there is indeed evidence of network externalities, which is also reflected by the second identifying variable i.e. The average number of treated farmers in the reference group is statistically significantly associated with the probability of adopting row planting (columns 1 and 3). Further, the results regarding the other controls are similar to the main results.

Table 3.9. The effect of social learning on the adoption of row planting, marginal effects of a Probit estimation‡

(Dependent variable: 1 if i adopts row planting, 0 otherwise)

	Networks of the household head				Networks of both spouses			
	dy/dx	Std. Err	dy/dx	Std. Err	dy/dx	Std. Err	dy/dx	Std. Err
Average value of peers' characteristics								
Change in ave. yield (2010-14)	-2E-05***	6E-06	-2.5E-05***	7E-06	-1.7E-05	1E-05	-2.6E-05*	1.4E-05
Share of treated	0.26**	0.12	0.18	0.11	0.26*	0.14	0.10	0.13
Network size	0.09	0.11	0.07	0.10	0.01	0.05	0.01	0.04
Network-size sq.	-0.01	0.01	-0.01	0.01	5E-04	0.003	0.00	0.00
Ave. age(years)(ln)	0.09	0.18	0.07	0.17	-0.03	0.21	-0.22	0.19
Ave. HH size(ln)	0.13	0.20	0.09	0.19	0.39	0.25	0.09	0.25
Ave. value of prod. assets(ln)	0.03	0.03	0.02	0.03	0.05	0.04	0.04	0.04
Ave. value of cons.durables(ln)	0.03	0.03	0.02	0.03	0.02	0.04	-0.03	0.04
Ave. livestockholdings(TLU)(ln)	0.04	0.12	0.02	0.11	0.06	0.14	0.13	0.13
Ave. landholdings(ha)(ln)	-0.01	0.10	0.02	0.10	-0.13	0.11	-0.02	0.11
Household characteristics								
Female HH head+	0.03	0.08	0.02	0.08	0.07	0.08	0.05	0.07
Age of HH head (years)	-0.01	0.02	-0.01	0.01	-0.01	0.01	-0.01	0.01
Square. of age of HH head	0.00	0.00	8E-05	1E-04	6E-05	0.00	0.00	0.00
Education 0-4(dummy)+	-0.04	0.08	-0.05	0.09	0.00	0.08	0.00	0.07
Education 5-8(dummy)+	0.11	0.07	0.10	0.06	0.13*	0.07	0.11*	0.06
Education 8+(dummy)+	0.08	0.08	0.08	0.07	0.07	0.08	0.08	0.06
Radio list.(freq)	0.00	0.00	0.00	2E-04	9E-05	0.0002	0.00	0.00
Tv watch.(freq)	0.00**	0.00	0.00**	2E-04	5E-04**	0.0002	0.00**	0.00
Nonfarm/business activities+	-0.01	0.07	-0.03	0.07	-0.02	0.07	-0.07	0.06
HH size (ln)	-0.02	0.08	-0.02	0.08	-0.02	0.08	0.00	0.07
Size of own land (ha)(ln)	0.18***	0.05	0.19***	0.05	0.18***	0.05	0.17***	0.04
Treated+	0.18***	0.06	0.16**	0.06	0.17***	0.06	0.14***	0.06
Dist. asphalt road(minutes)(ln)			0.06	0.06			0.10	0.07
Dist. market (minutes)(ln)			-0.09	0.07			-0.16***	0.09
Dist. district (minutes)(ln)			-0.05	0.28			0.86	0.40
Dist. coop office (minutes)(ln)			-0.02	0.05			-0.10	0.06
Dist. input dealer(minutes)(ln)			-0.01	0.08			0.01	0.10
Dist. FTC (minutes)(ln)			-0.02	0.06			0.09	0.07
Dist. MFI (minutes)(ln)			-0.20	0.29			-1.24***	0.41
Hitossa-Tiyo+	-0.8***	0.10	-0.73***	0.10	-0.74***	0.09	-0.57***	0.13
Adaa-Lume+	-1.0***	0.10	-0.81***	0.09	-0.89***	0.05	-0.67***	0.15
Observations	346		346		348		348	
Log lik.	-138.1		-133.4		-139.3		-130.6	
Pseudo R2	0.39		0.41		0.39		0.43	

†Note: dy/dx for factor levels is the discrete change from the base level. Other covariates fixed at their means. ‡Probit coefficients are reported in the appendix in Table A3. 5.

Finally, we include network size[36] measured by the number of links identified from all matches and its square for an additional test of robustness (Table 3.9). We observe that the main findings do not qualitatively change, thereby confirming that our main results are not driven by endogenous network size. This is further supported by the fact that neither network size nor its square are statistically significant.

[36] We also control for the fraction of randomly allocated matches the household knows in order to measure their connectedness in general. But results remain unchanged.

3.4.2.4. The effect of social learning on farm productivity

Social learning may occur not only in adopting a single innovation such as row planting but also in many other innovations and aspects, the collective effect of which may improve yields. In this context, we regress farm productivity (output/ha) on average values of group or network characteristics and other controls including individual and household-level characteristics as well as community-level fixed effects. We report regression results in Table 3.10 and Table 3.11. Results in columns 1 through 4 relate to networks of only the head of the household, while the remaining columns are based on the networks of both spouses taken together. To capture network externalities, we use average productivity of the reference group measured by present yields, past yields, and by the change in average productivity in a similar approach to the preceding section.

Referring to Table 3.10 column 1, our results suggest that own farm productivity is strongly associated with the average productivity of the reference group for the same production year. This result remains statistically significant when we extend the reference group to that of both spouses (column 5), thereby again presenting evidence of transitivity of relationships and clustering among networks. Even though these may suggest evidence of learning externalities, we cannot rule out the presence of a reflection problem since we are using peers' outcome from the same production year. Therefore, we re-estimate the model using lagged (i.e. the 2010) values of average productivity of the reference group. As the results in columns 2 and 6 show, the coefficient is positive and highly statistically significant, thus suggesting strong evidence of social learning or endogenous effects. Further, the coefficient on average livestock holdings of the reference group (columns 1-4) is positive and statistically significant, thereby suggesting that farm productivity increases with the increase in livestock holdings of one's networks. This evidence of contextual effects is not surprising as it is customary among rural households in Ethiopia to exchange or lend out livestock as draft power or for other farming activities. Finally, we also attempt to identify network effects using the change in average productivity of the reference group but the results are not statistically significant (see columns 3, 4, 7 and 8).

Moving on to the other results, we find that having primary education (1-4 years) and household size to be strongly associated with farm productivity in all specifications (columns 1-8). This may suggest that larger households have more labor which is an important input in small-scale agriculture in Ethiopia. Yet, we do not find other characteristics of the household to affect farm productivity.

Robustness check

Inclusion of network size and its square term in all the specifications as additional test of robustness do not change the results confirming that results are not driven by size of the network (Compare Table 3.10 against Table 3.11 where indicators of network size and its square term are included). Again, both indicators of network size and its square term are not statistically significant only supporting our claim that there is evidence of knowledge spill overs.

Table 3.10. The effect of social externalities on farm productivity

(Dependent variable: log (value of output per hectare of land))

	(1) HH_HEAD1	(2) HH_HEAD2	(3) HH_HEAD3	(4) HH_HEAD4	(5) ALLP1	(6) ALLP2	(7) ALLP3	(8) ALLP4
Average value of peers' characteristics								
Ave. yield_2014	0.28**				0.28**			
	(0.11)				(0.11)			
Ave. yield_2010		0.28*				0.33*		
		(0.14)				(0.19)		
Change in yield 2010-2014			0.00**				0.00	
			(0.00)				(0.00)	
Change in yield 2006-2010				0.00				0.00
				(0.00)				(0.00)
Ave. livestock holdings(TLU)(ln)	0.29***	0.28**	0.33***	0.32***	0.17	0.12	0.22	0.18
	(0.10)	(0.11)	(0.10)	(0.11)	(0.16)	(0.21)	(0.19)	(0.21)
Ave. landholdings(ha)(ln)	-0.07	-0.07	-0.11	-0.12	-0.16	-0.12	-0.22*	-0.22*
	(0.14)	(0.14)	(0.14)	(0.13)	(0.12)	(0.12)	(0.11)	(0.12)
Household characteristics								
Education of household head 1-4(dummy)	0.12**	0.13**	0.13**	0.15***	0.15**	0.17**	0.16**	0.19***
	(0.06)	(0.05)	(0.06)	(0.05)	(0.07)	(0.07)	(0.06)	(0.06)
HH size (ln)	0.52**	0.52**	0.53**	0.53**	0.50*	0.50**	0.50**	0.50**
	(0.25)	(0.25)	(0.25)	(0.26)	(0.25)	(0.25)	(0.25)	(0.25)
Hitossa-Tiyyo	0.49***	0.53***	0.62***	0.70***	0.48***	0.53***	0.61***	0.73***
	(0.14)	(0.17)	(0.17)	(0.10)	(0.12)	(0.15)	(0.15)	(0.07)
Adaa-Lume	0.13	0.04	0.19	0.16	0.14	0.02	0.19	0.16
	(0.15)	(0.19)	(0.17)	(0.16)	(0.13)	(0.19)	(0.15)	(0.15)
Constant	5.00***	5.23***	6.93***	7.18***	4.37**	4.51**	6.13***	6.49***
	(1.42)	(1.51)	(1.33)	(1.35)	(2.02)	(1.91)	(1.94)	(2.02)
Other controls≠	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	346	346	346	346	348	348	348	348
r2	0.24	0.24	0.23	0.23	0.23	0.23	0.22	0.22

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

≠Note: the following controls were included but the coefficients were not statistically significant: networks' characteristics (average: age, household size, value of productive assets, value of consumer durables); own household characteristics (dummy for female household head, age and square of age of the household head, dummies for education of the household head (5th-8th) grade and 8+ grade, dummy whether the household head engaged in business or wage labor, size of land holdings, dummy whether the household participated in NGO project intervention in the past).

Table 3.11. The effect of social externalities on farm productivity

(Dependent variable: log (value of output per hectare of land))

	(1) HH_HEAD11	(2) HH_HEAD21	(3) HH_HEAD31	(4) HH_HEAD41	(5) ALLP11	(6) ALLP21	(7) ALLP31	(8) ALLP41
Average value of peers' characteristics								
Ave. yield_2014	0.26**				0.28**			
	(0.11)				(0.12)			
Ave. yield_2010		0.26*				0.34*		
		(0.15)				(0.19)		
Change in yield 2010-2014			0.00**				0.00	
			(0.00)				(0.00)	
Change in yield 2006-2010				0.00				0.00
				(0.00)				(0.00)
Network size	-0.07	-0.10	-0.06	-0.09	0.09	0.08	0.10	0.09
	(0.20)	(0.19)	(0.19)	(0.19)	(0.09)	(0.09)	(0.08)	(0.08)
Network-size sq.	0.01	0.01	0.01	0.01	-0.01	-0.01	-0.01	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.00)	(0.01)
Ave. livestock holdings(TLU)(ln)	0.28**	0.28**	0.31***	0.31***	0.16	0.12	0.21	0.18
	(0.11)	(0.12)	(0.12)	(0.12)	(0.18)	(0.21)	(0.21)	(0.21)
Ave. landholdings(ha)(ln)	-0.06	-0.06	-0.09	-0.11	-0.17	-0.13	-0.22*	-0.23*
	(0.14)	(0.14)	(0.14)	(0.13)	(0.13)	(0.12)	(0.12)	(0.13)
Household characteristics								
Education 0-4(dummy)	0.11**	0.12**	0.13**	0.14***	0.16***	0.17***	0.18***	0.20***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
HH size (ln)	0.51*	0.51**	0.51**	0.51**	0.48*	0.50*	0.48*	0.49*
	(0.26)	(0.25)	(0.26)	(0.26)	(0.27)	(0.26)	(0.26)	(0.26)
Hitossa-Tiyyo	0.48***	0.53***	0.60***	0.67***	0.49***	0.54***	0.61***	0.73***
	(0.13)	(0.16)	(0.17)	(0.11)	(0.13)	(0.16)	(0.16)	(0.08)
Adaa-Lume	0.13	0.04	0.19	0.15	0.16	0.04	0.21	0.18
	(0.14)	(0.20)	(0.16)	(0.16)	(0.14)	(0.20)	(0.16)	(0.15)
Constant	5.22***	5.50***	7.01***	7.31***	4.06**	4.14**	5.79***	6.15***
	(1.44)	(1.54)	(1.25)	(1.29)	(2.03)	(1.92)	(1.92)	(1.95)
Other controls≠	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	346	346	346	346	348	348	348	348
r2	0.24	0.24	0.23	0.23	0.24	0.24	0.22	0.23

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

≠Note: the following controls were included but the coefficients were not statistically significant: networks' characteristics (average: age, household size, value of productive assets, value of consumer durables); own household characteristics (dummy for female household head, age and square of age of the household head, dummies for education of the household head (5th-8th) grade and 8+ grade, dummy whether the household head engaged in business or wage labor, size of land holdings, dummy whether the household participated in NGO project intervention in the past).

3.5. Conclusions

Existing studies on Ethiopian agriculture largely ignore the role of social networks for the adoption of agricultural innovations and improved farm productivity. This Chapter aims to contribute to filling this gap. We use purposefully collected data that combine conventionally-used network indicators such as membership in groups and self-reported networks of family and friends in addition to exogenously and randomly assigned matches. By eliciting details of the relationships between network members, their individual farming practices and yield performances, we examine the role each network type plays in terms of information or knowledge transfers for innovation and productivity. We use econometric strategies to isolate social learning from correlated and contextual effects and first examine which factors determine the formation of information links and whether those learning links are actually correlated with innovative behavior. We then examine the existence of social learning with respect to the adoption of row planting, a recent innovation in Ethiopian agriculture. Finally, we investigate social externalities in farm productivity.

Our results suggest that, as expected, belonging to certain groups such as *iddirs*, having some form of relationship with network members in terms of kinship or informal forms of insurance, or having a high frequency of meetings with a network member all seem to increase the probability of forming an information link. It appears, however, that the quality of information is more important when it comes to innovation behavior than the frequency of interaction. To be specific, we fail to find evidence for a relationship between these indicators and the probability of adopting row planting. Instead, we find that information links that exclusively involve discussions on farming or business matters are significantly correlated with the likelihood of adopting row planting.

Further, after controlling for factors that may otherwise generate spurious correlation, we find strong evidence of network externalities in the adoption of row-planting and in farm productivity. Our findings are in line with similar studies such as van den Broeck and Dercon (2011). Therefore, based on our findings, we conclude that extension services and other programs that promote agricultural innovations may benefit from social networks but they may achieve maximum impact if they identify networks that exclusively involve information exchange regarding agriculture. This suggests that farmer groups or cooperatives could be important tools for better delivery of agricultural extension and advisory services. This also implies that investment in the formation of groups, rather than simply using existing networks, could also be a strategy with high returns.

4. THE EFFECT OF ASPIRATIONS ON AGRICULTURAL INNOVATIONS IN RURAL ETHIOPIA

Abstract

This Chapter studies the effect of aspirations on the adoption of agricultural innovations in the context of rural Ethiopia. While most studies on agricultural innovations have focused on identifying observable and resource-related deprivations or 'external' constraints, a related stream of literature suggests that 'internal' constraints, such as the lack of aspirations, could reinforce external constraints and lead to self-sustaining poverty traps. Since both aspirations and the adoption of innovations are forward-looking, they are likely to be intimately linked. Aspirations are motivators that can enhance innovations or their adoption not only in their own right but also through their determinants, including self-efficacy, locus of control and other internal traits that may be unobserved. This implies that aspirations may affect innovations through multiple channels and hence may be endogenous. On the other hand, aspirations are also affected by a person's level of achievement, implying that aspirations and innovations may be simultaneously determined. To identify the effect of aspirations on the adoption of agricultural innovations, we conducted both plot-level and household-level analysis using purposely collected data from households in rural Ethiopia. Using econometric strategies that account for the endogenous nature of aspirations, we found that a narrow or a very wide gap between aspirations and achievement in a farming household is strongly associated with low levels of innovativeness and low adoption rate of innovation products such as chemical fertilizers. Policies promoting agricultural innovations may benefit if they incorporate aspirations-raising strategies.

Key words: Aspirations, innovations, agriculture, Ethiopia

4.1. Introduction

This Chapter studies the relationship between aspirations and innovation behavior in Ethiopian farmers. Previous studies on innovation have mainly focused on the adoption pattern of technologies, which have increased our understanding of why some technologies diffuse faster than others. Technology attributes, a farmer's perception of a technology (Adesina and Zinnah, 1993; Negatu and Parikh, 1999), land size, risk preferences, education, access to credit and extension services, wealth and labor endowment, roads, markets, tenure arrangement, and the availability of complementary inputs and networks are the main determinants identified in the literature studying innovations (for extensive reviews see Rogers, 1983; Feder et al., 1985; Feder and Umali, 1993; Foster and Rosenzweig, 2010).

However, these widely studied determinants of innovations have been mainly observable and resource-related, or, in other words, they are 'external' constraints. Any policies targeting purely at addressing them may not necessarily be able to bring about the desired change. This is because 'internal' constraints, such as the lack of

self-efficacy, could reinforce external constraints, and this may lead to a self-sustaining poverty trap and low levels of proactivity (Appadurai, 2004; Ray, 2006; Dalton et al., 2014). For example, Guyon and Huillery (2014) found that in France students from a low social background – such as having parents with a low education level or living in a disadvantaged neighborhood – exhibited low aspirations for education despite having the same academic abilities as students from a higher social background. However, policies could be used to induce motivation or protect people from falling into the trap of low aspirations and poverty. For example, following Bandura's (1977) theoretical exposition of how perceived self-efficacy and behavioral changes might be related, Bandura et al. (1977) empirically tested and showed that behavioral changes can be effected by altering the level and strength of self-efficacy.

Further, notwithstanding the importance of policy interventions aimed at relaxing external constraints, for example, the provision of credit and extension services, Bertrand et al. (2004) argued that highly consequential behaviors are often triggered by situational factors, also known as "channel factors", which may include psychological factors as addressed in the context of this paper. Thus, it is essential to consider and factor in internal constraints when designing social policy initiatives (Bandura, 2009) because at the very minimum they can enhance the effectiveness of policies that address material deprivation (Dalton et al., 2014).

The main objective of this Chapter is to investigate whether low aspirations or very wide (and narrow) aspiration gaps lead to a low adoption of agricultural innovations or a low degree of innovativeness in selected rural areas of Ethiopia. Aspirations are future-oriented, and they entail effort conditional on a person's belief in their own ability to change outcomes. This is also known as *self-efficacy*; having self-efficacy in turn implies a person has an *internal locus of control* – the belief that life outcomes are within their control (Bernard et al., 2011). Genicot and Ray (2014) argued that aspirations encourage a person to invest if they are moderately above their standard of living. In other words, the aspirations-gap – the difference between aspirations and achievement – affects future-oriented behavior. According to Ray (2006), when the aspirations-gap is either too narrow or too wide, we observe aspirations failure and people giving up (i.e., a lack of personal effort to raise their future living standards). This is because when the aspirations-gap is too narrow, the reward is considered too small for the effort, and when it is too wide, the gap will remain large regardless of the amount of effort put in. Yet, Ray (2006) noted that policies could be used to moderately open up the aspirations window (and hence the aspirations gap) or create a sense of possibilities (when the gap is wide) as long as people are not fatalistic or believe that their destiny is preordained.

Innovation is also future-oriented because it is about change. Thus, we hypothesize that innovation is closely linked to aspirations and that low aspirations or very narrow/wide aspirations-gap would lead to low innovations or low adoption rate of innovation products. The remainder of this paper is organized as follows: The next section contains the background and literature review. Section 4.3. introduces our theoretical model. Section 4.4. presents the data and empirical strategy. Results are discussed in section 4.5. And section 4.6. concludes the Chapter.

4.2. Background and literature review

The existing literature provides different theories and analytical tools that facilitate a better understanding of the circumstances of the poor and possible ways to help them out of the situation they are in.[37] Recent additions to the economics literature include a study of individual behavior using the aspirations-failure framework (see Bernard et al. (2011) for an extensive review, particularly in the Ethiopian context). On the other hand, innovation is regarded as an important avenue of bringing about change and sustaining development.[38] In the systems approach, innovation is broadly defined as "the process by which individuals or organizations master and implement the design and production of goods and services that are new to them, irrespective of whether they are new to their competitors, their country, or the world" (Ernst et al, 1998: pp.12-13). Agricultural innovations may involve use of agricultural technologies, improved practices, and institutional innovations and opportunities that can help facilitate interactions among different actors and improve efficiency and growth in the sector (World Bank, 2007).

The innovation systems concept (ISC) is particularly attractive because it gives attention to tacit knowledge, which is crucial in the case of developing countries (as opposed to codified knowledge) and yet "difficult to articulate or write down" and is "often embedded in skills, beliefs, or ways of doing things" (Mytelka, 1987; cited in World Bank, 2007). An aspect that is closely related and highly relevant to this study is the attention the ISC gives to attitudes and practices, which are important to innovation processes. According to Hall et al. (2006), attitudes and practices such as mistrust, being closed to others' ideas, secretiveness, lack of confidence, and limited scope and intensity of interaction are restrictive, while others such as trust, openness, transparency, confidence and proactive networking actually support innovation processes. This perspective could also offer a partial explanation to some "non-fully rational" behaviors that Duflo et al. (2011, 2008) observe in Kenya.

Unlike the widely held belief that low fertilizer adoption rates are due to low returns or credit constraints, Duflo et al. (2011, 2008) found that simple interventions (such as offering free delivery of fertilizer while selling them at full market price) just after harvest substantially increased the fertilizer adoption rate (the researchers found the effect comparable to that of a 50 percent reduction in the price of fertilizer later in the season). Surprisingly, Duflo et al. found that offering free delivery when fertilizer is actually needed had no significant impact on the fertilizer adoption rate. Findings like these motivate economists to explore alternative explanations by looking at other disciplines, substantiating the view that beliefs and/or internal factors, such as aspirations, could help in understanding individual decision-making.

Studying within the framework of the aspirations failure theory, Bernard et al. (2014) conducted a video-based experiment that featured success stories to test whether aspirations and future-oriented behavior can be altered. Using data collected six months after the video screening, Bernard et al. identified multiple treatment effects,

[37] For example, Amartya Sen's (1981) essay on entitlements and deprivation is considered the breakthrough in the analysis of poverty and famine that led to the development of related concepts that include the Human Development Index and many other multidimensional poverty measures.

[38] For example, G20 2011 communiqué of Ministerial Meeting on Development put emphasis on innovation in the context of agricultural development

including significant improvements in: aspirations, use of financial tools related to both savings and credit, the number of children enrolled in school, and the total spending on children's education. They also found a positive treatment effect on a hypothetical demand for loan – a result consistent with previous studies by Bernard et al. (2011), and Bernard and Taffesse (2012), which found evidence that low aspirations or external locus of control could be correlated with low demand for long-term loans and low use of such loans for long-term investments.

Other studies have also found strong correlation between the lack of aspirations and many factors, including the following: expenditures on agricultural inputs, yields, and savings (Kosec et al., 2012); savings choices and health-seeking behavior (Ghosal et al, 2013); career aspirations and educational attainment of adolescent girls (Beaman et al., 2012); private school enrollment (Galab et al., 2013); educational outcomes (Serneels and Dercon, 2014); and dropout behavior (Goux et al., 2014). In addition, Gorard et al. (2012) conducted a review on education, psychology and related social science literature that examine the importance of attitude and aspirations of young people and their parents on educational attainment and participation.

While existing studies have examined, mainly theoretically, the formation of aspirations and their role in various outcomes, the effect of aspirations on agricultural innovations remain largely unexplored. Related behavioral studies such as that by Kebede and Zizzo (2015) have shown the negative impact of social preferences, such as envy (which Kebede and Zizzo measured using a money burning experiment), on agricultural innovations. Other studies on innovation have focused on innovation adoption patterns mainly based on observable socio-economic characteristics (as described in the introduction of this paper). This study contributes to the literature by examining internal constraints, such as aspirations, as determinants of agricultural innovations.

4.3. Theoretical model

To understand the link between aspirations and the adoption of agricultural innovations, this paper adopts the theoretical model developed by Dalton et al. (2014).[39] The two key premises of the model are as follows:

i. aspirations are reference points that affect utility from achieving a particular status, but -
ii. aspirations are endogenous reference points in that they are affected by effort choices.

In this framework, an individual is assumed to have aspirations level (A) for their final wealth status (w_f), which is determined by their initial wealth (w_0) and the level of effort (e) they put in. This implies for the given initial status w_0, the individual's utility derived from achieving a particular status w_f by choosing effort level e also depends on their aspirations level (A). The individual's utility function can be described as:

$$u(e, A, w_f) = b(w_f) + v\left(\frac{w_f - A}{w_f}\right) - c(e) \quad (1)$$

Where:

[39] A detailed presentation and the corresponding proofs can be found in that paper.

- $w_f = f(e, w_0)$ is assumed to be an increasing function of effort e, $\{e \epsilon [0,1]\}$, which comes with some cost $c(e)$, whereby the cost function is assumed to be smooth, increasing and convex with $c(0) = 0$;
- $b(w_f)$ is assumed to be a smooth, increasing, concave function over final status with $b(0) = 0$;
- $v(.)$ is a continuously differentiable reference-dependent value function that captures the premise that individual aspiration level A is a reference point that affects the satisfaction experienced by achieving a final outcome w_f.

According to Dalton et al. (2014), poverty imposes external constraints (e.g., lack of access to information or credit to acquire skills), which effectively reduce the productivity of the poor. Consequently, for a given effort level, final wealth is proportional to initial wealth$\{w_f = f(e, w_0)\}$, which clearly puts the poor at a disadvantage since the marginal product of effort increases with initial wealth. This would subsequently cause the poor to limit their effort choice and thereby their aspirations level since agents would aspire only to achieve an outcome that is perceived as attainable. This gives rise to the model's second premise that aspirations are endogenous to an effort choice. Therefore, at a given effort level, aspirations level A can be defined as the final outcome attained[40]:

$$A = f(e, w_0) \tag{2}$$

The two premises of the model together imply a two-way feedback between aspirations and effort. Thus, to find an optimal level of status and utility, the rational solution would be to jointly choose an effort level and an aspirations level $(\hat{e}, \hat{A})$ such that:

$$\hat{e} \epsilon \arg max\ s(e, w_0) = u\big(e, f(e, w_0), f(e, w_0)\big) \tag{3}$$

where $e \epsilon [0,1]$ and,

$$\hat{A} = f(\hat{e}, w_0) \tag{4}$$

However, as the evidence presented in the literature review suggests, most individuals may lack the foresight to recognize the feedback effect and therefore may not make decisions in this manner. Such people are referred to as behavioral decision-makers. Hence, according to Dalton et al. (2014), a behavioral decision-maker regards their aspired status A as fixed (instead of endogenously evolving with effort and achieved status), thus imposing an externality on themselves that is not fully internalized. Hence, for a fixed initial wealth level, the behavioral solution is $(\ddot{e}, \ddot{A})$, which is different from (or less than) the rational solution $(\hat{e}, \hat{A})$, and the decision-maker is internally constrained. This implies that poverty and initial disadvantage interact to generate a behavioral poverty trap characterized by minimal effort-aspirations pair.

[40] The basic assumption is that everyone can reach their aspirations; and that reaching aspirations does not necessarily imply aspiring optimally (Dalton et al., 2014)

The implication is that interventions could be used to break behavioral poverty traps simply by raising the aspirations of the poor. Interventions can also be used with mechanisms that increase individual wealth or reduce the cost of effort (e.g., cost of innovations) faced by the poor. Hence, using agricultural innovations as a proxy for effort and as an avenue of improving rural livelihoods, this Chapter aims to find out whether aspirations actually determine agricultural innovations.

4.4. Data and empirical strategy

4.4.1. Empirical model

Following the literature review and theoretical framework outlined in the previous sections, we now present our estimation strategy. Innovations are efforts to achieve a certain outcome, and they may require patience and risk-taking, which are central to the decision-making process. Aspirations, on the other hand, are motivators which can enhance innovation and effort allocation to facilitate innovation not only by themselves but also indirectly through other determinants such as risk preferences which may be unobserved. This again implies that aspirations may affect innovations through multiple channels and hence may be endogenous or simultaneously determined.

Since individuals with different level of aspirations (i.e., those with lower aspirations and those with higher aspirations, or between people with moderate aspirations-gap and narrow/large aspirations-gap) may generate data differently, a simple regression model may not capture variations both within a group and between groups of individuals. An alternative approach is to sort individuals into two groups, or 'positions', based on their aspirations status. However, as noted above, outcomes (or innovations) and aspirations are simultaneously determined, which can lead to selection bias as categorizing people into the two positions would not be random. Hence, among the estimation strategies that allow joint determination of endogenous discrete variables and the outcomes they affect, endogenous switching models are preferred (Mare and Winship, 1987; Adamchik and Bedi, 2000; Di Falco et al., 2011). According to Mare and Winship (1987), the main advantages of an endogenous switching model are that they allow us to model both the allocation of persons to various 'treatments' and the effects of treatment on other outcomes; estimate the degree to which common, unmeasured variables affect both the outcome and explanatory variables; take account of the potential selection bias; and estimate the impact of the classification regime by simulating how individuals would fare had they entered different 'treatment' groups.

Formally, the determination of household innovations can be expressed as the following function:

$$y_j = f(A, IN, HH, C, V) \quad (5)$$

Where y_j represents innovations implemented by the household, *A* represents the aspirations status, *IN* denotes other individual characteristics, *HH* and *C* respectively denote household and community level characteristics that may influence innovations, and *V* represents location- or village-fixed effects. But for the ease of

presentation, let t_j denote the 'treatment' variable A, and X_j denote IN, HH, C and V. Following Wooldridge (2010), the above function can be expressed as an endogenous treatment-effects model with the regression form:

$$y_j = X_j\beta + \delta t_j + \varepsilon_j \quad (6)$$

where t_j is a binary-treatment variable that is assumed to stem from an unobservable latent variable:

$$t_j^* = w_j\gamma + \upsilon_j \text{ with } t_j = \begin{cases} 1, if\ t_j^* > 0 \\ 0, otherwise \end{cases} \quad (7)$$

where w_j are the covariates used to model aspirations status (or treatment), and the error terms ε_j and υ_j are bivariate normals with mean zero and covariance matrix $\begin{bmatrix} \sigma^2 & \rho\sigma \\ \rho\sigma & 1 \end{bmatrix}$. The covariates X_j and w_j are unrelated to the error terms, or they are exogenous.

The log-likelihood of observation j is given by:

$$lnL_j = \begin{cases} ln\Phi\left\{\frac{w_j\gamma + \frac{(y_j - X_j\beta - \delta)\rho}{\sigma}}{\sqrt{1-\rho^2}}\right\} - \frac{1}{2}\left(\frac{(y_j - X_j\beta - \delta)}{\sigma}\right)^2 - ln\sqrt{2\pi\sigma}\ ,\ t_j = 1 \\ ln\Phi\left\{\frac{-w_j\gamma - (y_j - X_j\beta)\rho/\sigma}{\sqrt{1-\rho^2}}\right\} - \frac{1}{2}\left(\frac{(y_j - X_j\beta)}{\sigma}\right)^2 - ln\sqrt{2\pi\sigma},\ t_j = 0 \end{cases} \quad (8)$$

Where $\Phi(.)$ is the cumulative distribution function of a standard normal distribution.

The Stata program *etregress* (StataCorp, 2013) was used for the estimation of the endogenous treatment-effect model with maximum likelihood when the dependent variable is continuous. Binary dependent variables were estimated using the endogenous switching model with full-information maximum likelihood. To fit the model, a "wrapper" program, *ssm,* which calls for the *gllamm* Stata program (Miranda and Rabe-Hesketh, 2006) was used. Miranda and Rabe-Hesketh argued that the identification of the model does not require identifying restrictions, even though it would be a good practice to specify at least one exclusion restriction. A description of the model can be found in the paper by Miranda and Rabe-Hesketh (2006) and will not be presented here because it is similar to the treatment-effects model described above.

When the dependent variable is a count number, we followed Cameron and Trivedi (2010) and used a structural model, also known as the control function approach. Similar to the switching model, this approach also defines explicit models for both the dependent variable (y_j) and the endogenous regressor (t_j). The basic assumption is that the structural equation for the count variable y_j is a Poisson model with a mean that depends on an endogenous regressor:

$$y_j \sim \text{Poisson}\ (\mu_j) \text{ and}$$

$$\mu_j = \mathrm{E}(y_j|t_j, X_j, \upsilon_j) = exp(\beta_1 t_j + X_j'\beta_2 + \upsilon_j) \quad (9)$$

where the error term υ_j can be interpreted as unobserved heterogeneity and is assumed to be uncorrelated with X_j but correlated with t_j, allowing for endogeneity. The addition of υ_j also controls for overdispersion in the Poisson model. The interdependence between $t_j$and υ_j is specified as:

$$t_j = X_j'\gamma_1 + w_j'\gamma_2 + \varepsilon_j \quad (10)$$

Where w_j is a vector of exogenous variables that affect t_j nontrivially but does not directly affect y_j, which is commonly known as an instrument or an exclusion restriction. Further, the errors υ_j and ε_j are assumed to be related via:

$$\upsilon_j = \rho\varepsilon_j + \eta_j \quad (11)$$

where $\eta_j \sim [0, \sigma_\eta^2]$ is independent of $\varepsilon_j \sim [0, \sigma_\varepsilon^2]$. Consequently, this means that ε is a common latent factor that affects both y_j and t_j and is the only source of dependence between them after controlling for the influence of the observable variables X_j and w_j. If $\rho = 0$, then t_j can be treated as exogenous. Otherwise, t_j is endogenous since it is correlated with υ_j in (10) because both t_j and υ_j depend on ε.

Now, substituting (11) for υ_j into (9) yields $\mu_j = exp(\beta_1 t_j + X_j'\beta_2 + \rho\varepsilon_j)e^{\eta}$. Then, taking the expectation of μ_j with respect to η yields:

$$\mathrm{E}_\eta(\mu) = exp(\beta_1 t_j + X_j'\beta_2 + \rho\varepsilon)\mathrm{E}(e^{\eta}) = exp(\beta_1 t_j + ln\mathrm{E}(e^{\eta}) + X_j'\beta_2 + \rho\varepsilon) \quad (12)$$

The constant term $ln\mathrm{E}(e^{\eta})$ can be absorbed in the coefficient of the intercept, a component of X_j. It follows that:

$$\mu_j|X_j, t_j, \varepsilon_j = exp(\beta_1 t_j + X_j'\beta_2 + \rho\varepsilon_j) \quad (13)$$

Where ε_j is a new additional variable, and the intercept has absorbed $\mathrm{E}(e^{\eta})$. If ε were observable, including it as a regressor would control for the endogeneity of t_j. Given that it is unobservable, the estimation strategy is to replace it by a consistent estimate from a two-step estimation procedure as follows. First, equation (10) is estimated using OLS and the residuals $\acute{\varepsilon}_j$ are generated. Second, parameters of the Poisson model given in (13) are estimated after replacing ε_j by $\acute{\varepsilon}_j$. Finally, if $\rho = 0$ in the second stage, robust estimates can be drawn by adding the command *vce(robust)* option. But if $\rho \neq 0$, then the VCE needs to be estimated with the bootstrap method that controls for the estimation of ε_j by $\acute{\varepsilon}_j$ (Cameroon and Trivedi, 2010).

4.4.2. Sampling and measurement issues

The data was collected through a household survey carried out between January and March 2014 in Ethiopia. The survey revisited an existing sample of agricultural households surveyed in 2006 and again 2010 in Oromia region under an NGO project, which ended in 2010, aimed at promoting agricultural innovations. The original survey used a mix of purposive and random sampling procedures to select 390 households from three study sites (Aredo et al., 2008). The primary sampling unit consisted of a pair of neighboring districts, or *woredas*, which were chosen based on the planting density of their major crop and whether they had active farmers' cooperatives. At the second stage, *kebeles* (subdistricts) with active farmers' cooperatives were selected. Using the number of participating households within a cooperative as the sampling frame, households were randomly selected. The major crop and total sample size at each research site are summarized in Table 4.1. As shown in Table 4.1, one to three households in each district dropped out of the survey for various reasons, including death, relocation to another area and unavailability for the survey interview. Nevertheless, when compared against the full sample, the households that dropped out of the survey did not show any statistically significant baseline difference with regards to key indicators such as income, wealth, and landholdings (results not reported but available upon request).

Table 4.1. Geographic distribution of the sample households

	Bakko- Siree site (Maize crop)		Lume-Adaa site (Tef crop)		Hettosa-Tiyyo site (Wheat crop)		Sample size
District	Bakko	Sibu Siree	Lume	Adaa	Hettosa	Tiyyo	Total
Sample size at baseline (2006)	65	65	65	65	65	65	390
Sample size (2014)	64	63	63	64	62	63	379

4.4.2.1. Psycho-social indicators

The new survey included a module that asked about aspirations and other internal features. The module was identical to the one used by Bernard and Taffesse (2014), and the instrument passed their test for validity and reliability based on a test-retest approach (for details, see Bernard and Taffesse, 2014).

To capture aspirations and expectations, the instrument asked the respondents about:

- First, their current level, aspired level, and expected level with regards to four dimensions (income, wealth, social status, and children's education).[41] Wealth (or current value of assets) and income (annual income from agriculture and non-agricultural activities) were reported in terms of Ethiopian Birr; children's education in terms of education level; and social status in terms of the percentage of the village population that had asked the individual for advice on important decisions. [42]

[41] Since individuals aspire to achieve different things, depending on their experiences and the information set they have, relying on any single indicator may not suffice for measuring a person's aspirations. Nonetheless, these four indicators are believed to be strongly correlated with many dimensions a person might want to achieve in their life. Hence, the aggregate index is comprehensive enough to use as a strong proxy for a person's aspirations.

[42] Since attitudinal measures such as aspirations are likely to be measured with errors, normalization would help to smooth out errors at individual level. Further, normalization also makes individual indicators unit free, a prerequisite for aggregation as explained next.

- Second, the weight or relative importance they place on each of the four aforementioned dimensions. The respondents were each given 20 beans and a piece of paper with four squares, each labeled with one of the four dimensions. Then the respondents were asked to distribute the beans in the four squares according to the importance of each dimension to them.

Following Beaman et al. (2012), Bernard and Taffesse (2014), and Kosec et al. (2012), a respondent's aspirations level was calculated using an aggregate index based on their answers to the questions about their aspirations for each of the four dimensions. The index is constructed by first normalizing each dimension (i.e., by removing the average level for individuals in the same district and then dividing this difference by the standard deviation for individuals in the same district) and then multiplying the result by the weight the respondent gave to the dimension. The aspiration index was derived by summing the weighted average of the four normalized outcomes.[43]

Mathematically, the aspirations index (A_i) [44] can be represented as:

$$A_i = \sum_{n=1}^{4} \left(\frac{a_n^i - \mu_n^d}{\sigma_n^d} \right) w_n^i \qquad (14)$$

Where:

a_n^i is the aspired outcome of individual i on dimension n (income, assets, education, or social status).

μ_n^d is the average aspired outcome in district d for outcome n.

σ_n^d is the standard deviation of aspired outcomes in district d for outcome n.

w_n^i is the weight individual i places on dimension n.

In addition, the survey instrument also asked several questions to capture factors that help shape aspirations. These include factors associated with cognitive processes, such as locus of control, perception on the causes of poverty, attitude towards change, self-esteem, envy, and trust. The psychosocial indicators are measured using Likert-type scales (see Table 4.2).

[43] The expectation index is constructed using the same method.

[44] Relatedly, aspirations-gap is the difference between the aspired outcome and current level in terms of each of the four dimensions. The individual aspirations-gap index is calculated by dividing the aspirations-gap with the aspired outcome of each dimension. The weighted sum of the individual aspirations-gap indices of the four dimensions gave the aggregate aspirations-gap index. A dummy for narrow/large aspirations-gap was then constructed as follows. First, we classified individuals into three groups (i.e., narrow, moderate and very wide) according to their level of aspirations-gap index (or AG_i). To do this, we employed the formula used by Bandiera and Rasul (2006) to categorize individuals into three relative poverty statuses: poor, moderate and rich. Accordingly, the aspirations-gap of an individual was considered NARROW if AG_i was < 75% of sample average, MODERATE if AG_i was between 75% and 125% of sample average, and VERY WIDE if AG_i was > 125% of sample average. (Alternatively, the aggregate aspirations-gap index can be used to classify individuals into 5 quintiles. In this case, the bottom 1 and top 1 quintiles could represent narrow and very large aspirations-gap respectively). Since theory suggests both narrow and very large aspirations-gap are unconducive for proactive behavior (or innovations), they were put together to form one category (taking the value of 1). The middle represents moderate aspirations-gap and form the second category (taking value of 0).

Table 4.2. Brief description of internal factors and measurement

Internal factor	Each of these factors was constructed from an individual's response to different statements read to them about their lives. Most of the responses were coded on a 4-point scale: *strongly disagree, disagree, agree or strongly agree*. Those marked with an asterisk had only 2 choices, and the rest are defined below.
Self-esteem	Standardized index constructed from 6 items. Responses were recoded to reflect higher self-esteem
Internal locus of control	A standardized index constructed from 14 items that reflect a respondent's perception of whether life outcomes are controlled by: (1) oneself (internality), (2) powerful people (powerful others), or (3) chance. Responses were recoded to reflect internal locus of control
Perception of cause of poverty as external	A standardized index constructed from 12 items which reflect the respondent's perception of whether the causes of poverty are (1) individual, (2) fate, or (3) structural. Responses were recoded to reflect that causes of poverty are external factors
Openness to change*	A standardized index constructed from 7 items which reflect the respondent's attitude to change and adherence to community norms. Responses were coded to reflect more openness to change.
Competition/envy*	A standardized index constructed from 3 items which reflect the respondent's sense of rivalry/envy/competition. Responses were coded to reflect more envy.
Trust in others	A standardized index constructed from 2 items which reflect the respondent's sense of trust in others. Responses were coded to reflect higher trust.
Subjective well-being	A standardized index constructed from 2 items which reflect the respondent's perception of own life condition. Respondents were asked to define (a) "best/worst life" and (b) "happy/miserable life" on a scale of 10. Responses were coded to reflect higher subjective well-being.
Time preference (impatience)	An index constructed from 4 choices. Respondents were asked to choose whether they prefer to receive a certain amount of money today or a higher amount at a later date. Responses were recoded to reflect impatience.
Risk aversion	An index constructed from results of two hypothetical decisions: (1) lottery choices with payouts determined by a coin toss, and (2) choices among selling price of a bag of maize with same structure as the lottery payouts x 100. Responses were recoded to reflect less risk aversion.

4.4.2.2. Innovation and adoption indicators

Innovation and adoption behavior of farmers were measured using different indicators. First, to elicit innovativeness, farmers were asked the following question with regards to 12 value chain innovations:

Question: In the past 5 years, have you changed the way, or do you have a new or better way of [….][45]*?*

Using the twelve responses (1 yes, 0 otherwise), the innovation index (Y_j) was calculated as:

$$Y_j = \sum_{n=1}^{12} I_{ij} \quad (15)$$

where I_{ij} refers to the type of innovation i individual j implemented, and $Y_j = [0, 12]$.

Innovation adoption was measured in two steps. First, respondents were asked if they had access to or used a certain innovation (i.e., the type of innovation). Second, conditional on adoption, respondents were asked to report the intensity of use (unit/ha) of the specific agricultural technologies (such as fertilizer, improved seeds, herbicides and pesticides) and other agronomic practices (such as improved planting methods) (see Table 4.5).

[45] This question asked about **changes** in the context of farming practices. For example, the farmers were asked questions about the changes in: the crops they grow in each season, the kind of seeds they used and the places they buy the seeds, the type and quantity of other inputs they use (e.g., fertilizer and chemicals), their use of improved agronomic practices (e.g., planting techniques and land preparation), in the adoption of soil and water conservation (e.g. mulching, zero or reduced tillage, use of crop residue, water harvesting and drip irrigation), marketing information, and credit and loans?

4.5. Results and discussion

4.5.1. Descriptive statistics

We begin by presenting a general overview of the study sites in terms of their household characteristics, such as demography, resources, and membership in groups. Table 4.3 indicates that, on average, the sample households in the three sites have similar characteristics. Only a few exceptions were found in the Bakko-Sire site, where some indicators showed slight differences. According to the results, the household heads in Bakko-Sire were on average slightly younger and more educated. The area also had slightly larger households and a marginally lower percentage of female-headed households.[46] Considering the full sample, the data suggest that about 9 percent of the households were headed by females. The average age and schooling attainment of household heads was about 50 years and 4.6 years, respectively. The average family size was about 6.8 people with a 0.39 dependency ratio. The average size of livestock and land holdings in the sample was about 8.2 tropical livestock units and 3 hectares, respectively. The average number of days households were in contact with agricultural extension agents was about 8 days. The number of social groups households belonged to was about 6.9, on average. About 70 percent of the households were project beneficiaries between 2006/07 and 2010.

Table 4.3. Descriptive statistics on demographics, endowment, membership in groups, and other factors

	Bakko-Sire (N=115)		Hitossa-Tiyo (N=124)		Adda-Lume (N=124)	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Sex of household head (1 if Female)	0.04	0.20	0.14	0.35	0.10	0.30
Age of household head (in years)	45.2	13.1	54.2	13.2	51.7	12.2
Number of years of schooling completed by household head	5.31	3.94	4.55	4.39	3.98	3.89
Household size (number of household members)	7.46	2.39	6.50	2.23	6.47	2.32
Dependency ratio (number of dependents divided by number of working adults	0.45	0.20	0.38	0.20	0.33	0.21
Household head participates in business or wage labor (1 yes)	0.57	0.50	0.44	0.50	0.44	0.50
Livestock holdings (in Tropical livestock unit, TLU)	8.29	6.05	7.74	4.49	8.67	5.09
Total land size accessed by household (hectare)	2.92	2.20	3.18	1.96	2.98	1.66
Total land size used for main crop (hectare)	2.09	1.83	2.66	1.91	2.70	1.62
Number of days of contact with extension agent	7.62	8.11	8.19	9.22	10.54	12.46
Number of groups household belongs to	6.27	2.71	7.89	3.28	6.36	2.84
Household was project beneficiary in the past (1 yes)	0.69	0.47	0.71	0.46	0.70	0.46

Employing the formula described in equation (14) for the computation of aggregate aspirations and expectations indices results in only a marginally skewed (to the right) distribution of the aspirations and expectations scores (Figure 4.1a and Figure 4.1b); this indicates that the sample is a fair representation of the population. The aggregate indices were also used to classify individuals into the low and high groups according to the level of their aspirations and expectations by comparing their scores to the district average. Table 4.4 indicates that about 33% and 41% of household heads had low aspirations and low expectations, respectively. Female household heads were also more likely than their male counterparts to have low aspirations and expectations. Further, wealthier and more highly educated individuals were less likely to have low aspirations and low expectations. Surprisingly, a higher percentage of household heads in the younger age groups showed low aspirations and low

[46] These slight differences may have occurred because households that did not cultivate any of the three main crops were omitted from the analysis. The households were omitted because the focus of this study is limited to the three main crops.

expectations. Perhaps, this could be because of their limited experience and information set and hence narrow aspirations window.

Figure 4.1. Distribution of aspirations and expectations indices

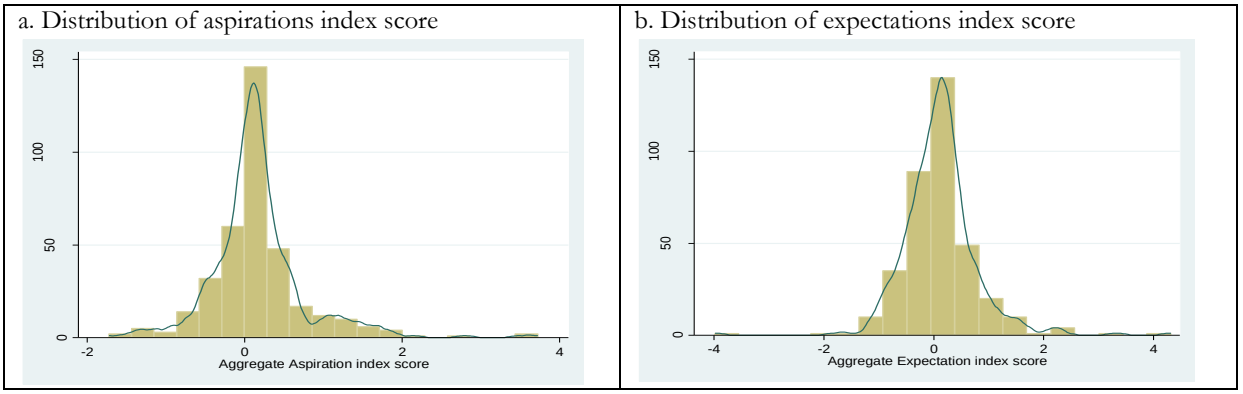


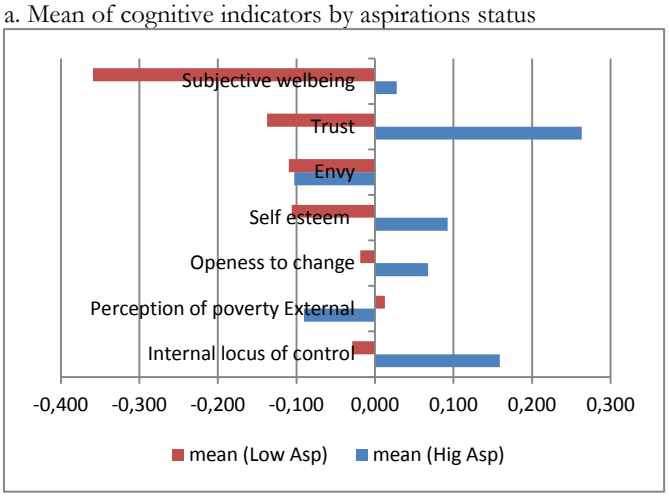
Table 4.4. Share of household heads with low aspirations and low expectations

	Low Aspirations	Low Expectations
All	0.33	0.41
By sex		
Male	0.30	0.39
Female	0.56	0.65
By age group		
age 15-30	0.55	0.50
age 31-50	0.27	0.35
age 51+	0.36	0.47
By education group		
education		
none	0.47	0.61
0-4 grade	0.41	0.55
5-8 grade	0.19	0.29
9+ grade	0.21	0.16
By wealth quintile		
Q1 poorer	0.64	0.65
Q2	0.34	0.53
Q3	0.31	0.37
Q4	0.23	0.33
Q5 richer	0.15	0.20
By per-capita expenditure quintile		
Q1, poorer	0.56	0.59
Q2	0.33	0.52
Q3	0.23	0.36
Q4	0.29	0.38
Q5, richer	0.23	0.23

Other cognitive processes might determine an individual's level of aspirations. Figure 4.2 presents the mean standardized outcomes of some cognitive indicators by aspirations level. The mean comparison tests (Figure 4.2b) showed that people with higher aspirations exhibited higher internal locus of control, higher self-esteem, more trust in others, higher subjective well-being, and lower risk aversion. Further, the results suggested that, on average, people with high aspirations were less likely to perceive external factors as the cause of poverty. All these results were statistically significant. There was not much difference between the two groups in other cognitive indicators such as openness to change, envy (competitiveness) and patience.

Figure 4.2. Descriptive statistics on cognitive indicators

a. Mean of cognitive indicators by aspirations status



b. Mean comparison test

	High Asp. (N=245)	Low Asp. (N=118)	t test
Index	mean	mean	p-value
Internal locus of control	**0.16**	**-0.03**	**0.000**
Perception on causes of poverty - External	**-0.09**	**0.01**	**0.033**
Openness to change	0.07	-0.02	0.105
Self-esteem	**0.09**	**-0.11**	**0.000**
Envy	-0.10	-0.11	0.945
Trust	**0.26**	**-0.14**	**0.000**
Subjective well-being	**0.03**	**-0.36**	**0.000**
Impatient	2.28	2.25	0.877
Less risk averse	**6.19**	**5.56**	**0.036**

Several innovation and adoption indicators were examined in this study in terms of innovativeness (the use of innovations) and the intensity of use of the adopted innovations. The results (Table 4.5) suggested that on average male-headed households exhibited higher innovativeness and adopted row-planting techniques more frequently than female-headed households. They also displayed higher intensity of fertilizers use (kg/ha). However, there did not seem to be much difference between the sexes in terms of the following aspects: (1) access to fertilizers, herbicides and pesticides, and improved seeds; (2) the adoption of sustainable natural resource management practices (SNRMPs); (3) the intensity of use of herbicides and pesticides, and improved seeds; and (4) the intensity of general innovativeness (innovativeness index). This result, without accounting for other determinants of innovations, implies that gender may not play a statistically significant role in terms of access to and use of some of these innovations. This will be econometrically checked in the next section after controlling for other determinants.

Table 4.5. Comparison of innovation/adoption by sex of household head (M=329, F=34)

	Male (N=329)		Female (N=34)		t-test: mean difference
	Mean	Std. Dev.	Mean	Std. Dev.	p-value
Innovation/adoption (1 Yes, 0 otherwise)					
Innovativeness	0.92	0.27	0.82	0.39	**0.069**
Fertilizer use	0.98	0.13	0.94	0.24	0.126
Herbicides/Pesticides use	0.94	0.24	0.91	0.29	0.533
Improved seed use	0.57	0.50	0.47	0.51	0.246
Conditional intensity of innovation/adoption (unit/ha)					
Innovation index [1,12]	5.58	2.89	5.18	2.58	0.479
Fertilizer use (kg/ha)	176	87	145	70	**0.051**
Herbicides/Pesticides use (Lt/ha)	1.40	1.70	1.67	2.36	0.417
Share of land with improved seeds	0.66	0.29	0.61	0.33	0.555
Plot level indicators (N=1595)					
SNRMP* (Index [0,9])	1.70	0.99	1.60	0.80	0.305
Planting method (1 row-planting, 0 otherwise)	0.31	0.46	0.21	0.41	**0.033**

*SNRMP= composite index of sustainable natural resource management practices employed at each plot. These practices comprise of mulching, terraces, reduced tillage, use of crop residue, water harvesting, use of drip irrigation, compost, manure and crop rotation.

A comparison of innovations by aspirations and expectations status also revealed statistically significant differences. For example, individuals with high aspirations tended to have higher innovativeness and be more likely to adopt innovation products, including fertilizers and improved seed; the results were statistically significant (Table 4.6). However, people with high expectations seem to perform better only in terms of the innovativeness index. Further, when considering only the households that had actually innovated or adopted any of the given technologies, those with high aspirations used more fertilizers per hectare of land and had higher share of land planted with improved seeds. Similarly, people with high expectations seemed to be more innovative, have higher share of land planted with improved seeds, and adopted more SNRMPs, on average.

Table 4.6. Comparison of innovation/adoption by aspirations and expectations status

		High Asp.		Low Asp.		t-test	High Exp.		Low Exp.		t-test
	N	Mean	Std. Dev.	Mean	Std. Dev.	(p-value)	Mean	Std. Dev.	Mean	Std. Dev.	(p-value)
Innovation/adoption (1 Yes, 0 otherwise)											
Innovativeness	363	0.93	0.25	0.86	0.35	**0.014**	0.95	0.21	0.85	0.36	**0.001**
Fertilizer use	363	1.00	0.06	0.94	0.24	**0.001**	0.98	0.14	0.97	0.16	0.615
Herbicides/Pesticides use	363	0.95	0.22	0.91	0.29	0.106	0.95	0.22	0.92	0.27	0.276
Improved seed use	363	0.62	0.49	0.45	0.50	**0.002**	0.60	0.49	0.52	0.50	0.150
Conditional intensity of innovation/adoption (unit/ha)											
Innovation index [1,12]	330	5.69	2.93	5.23	2.70	0.181	5.99	2.82	4.84	2.80	**0.000**
Fertilizer use (kg/ha)	355	180	87	160	82	**0.040**	179	89	166	82	0.164
Herbicides/Pesticides use (Lt/ha)	340	1.43	1.78	1.40	1.76	0.866	1.50	1.89	1.30	1.58	0.301
Share of land with improved seeds (%)	205	0.62	0.30	0.75	0.25	**0.006**	0.62	0.31	0.72	0.26	**0.021**
Plot level indicators (N=1595)											
SNRMP (Index [0,9])		1.68	0.98	1.73	0.96	0.389	1.73	0.97	1.61	0.97	**0.014**
Planting method (1 row-planting, 0 otherwise)		0.31	0.45	0.28	0.46	0.318	0.29	0.45	0.31	0.46	**0.397**

The bivariate analysis presented in this section clearly indicated that aspirations and expectations might be important determinants of agricultural innovation. The analysis further suggested that the sex of the household head could also matter for certain innovations. In the next section, econometric techniques are used to examine if the findings in this section hold after controlling for other determinants.

4.5.2. Econometric results

This section presents regression results from various specifications. Estimation techniques described in section 4, such as endogenous treatment effects, simultaneous equation with endogenous switching, and the control function approach were used. To improve identification, indicators of parental involvement in different local institutions – such as *kebele* committee, *iddir* (funeral organization), religious groups, cooperatives – and the ratio of own income growth to the average income growth in the same district between 2006 and 2010 were used as the main exclusion restrictions. In addition to satisfying the statistical requirements of relevance and excludability from the first-step regressions, instruments also need to be theoretically valid. Next we explain why this is the case in this study.

Past active involvement or leadership experience in local institutions is likely to have exposed parents to new information that can be passed on to their own household members, including children. This in turn is likely to

have broadened their children's *aspirations window*. Holding leadership positions would also give an individual a higher social status in their community, which would consequently influence their children's aspirations during the same period. Since present aspirations are linked to past aspirations, the instruments are relevant. On the other hand, since parent's past involvement in local institutions is not directly linked to innovation, it would most likely affect their children's present innovation behavior only through its effect on their aspirations. Hence, the instruments are excludable, satisfying the second requirement of a theoretically valid instrument.

The other instrumental variable is the ratio of a household's income growth to the average income growth in the community in the past. The actual income growth in the past may affect present innovation. However, since the relative position (i.e. the ratio) of the household's income growth is exogenously determined and not by the individual, it cannot directly affect innovation and hence is excludable. Further, since this outcome is measured in the past, present innovation could not have affected past income. On the other hand, since aspirations are formed by comparing own outcomes to other people's outcomes, the instrument is linked to aspirations and hence necessary, fulfilling the requirements of a theoretically valid instrument.

It should be noted that, however, not all these indicators were able to pass formal statistical tests for a valid instrument in all specifications. Rather, each of the indicators were used only in specific regressions in which they satisfy the requirements.[47] Due to the highly endogenous nature of aspirations, more instruments were hard to come by with the existing data. Results are compared against those estimated under the exogeneity assumption of aspirations. Various innovation indicators were considered in the analysis, and the results are summarized below.

Result 1: Effect of low aspirations (and narrow/large aspirations-gap) on innovativeness of farmers

Table 4.7 and Table 4.8 present the estimated effect of aspirations on a farmer's innovativeness. After controlling for other factors, the results in Table 4.7 suggested that aspirations are important determinants of household innovativeness. For example, based on the exogeneity assumption, the results of the negative binomial regression (column 1) suggested that there was a statistically significant difference in innovation behavior between households with low aspirations and those with high aspirations. This result, however, is not robust because the estimated coefficient loses statistical significance when controlling for other determinants (column 2), possibly because aspirations are endogenous to innovativeness. Hence, we employed a control function estimation technique to account for the potential endogeneity bias. While the results (column 3) seemed to show that low aspirations are negatively associated with the innovation index, the estimated coefficient is not statistically significant. According to Ray (2006), it is not aspirations per se but rather the aspirations-gap that non-linearly affects behavior.

[47] The Stock and Yogo (2005) test for weak instruments was used for various specifications. The null hypothesis of weak instrument was rejected using either a minimum value of 10 (a rule of thumb for *F* statistic), or the minimum eigenvalue statistic to tolerate distortion for a 5% Wald test based on the LIML estimators. Hansen's test of over identifying restriction was not rejected, therefore implying that the instruments were valid. Further, falsification tests were also conducted. Results are not reported here because of space constraints, but they are available upon request. Other parental characteristics such as education, their involvement in savings group, membership in a school's parent committee were also considered, but they did not pass the statistical tests for weak instrument.

Hence, we employed a negative binomial estimations technique and controlled for other factors, and two dummies representing aspirations-gaps reflecting the hypothesized non-linear relationship between the aspirations-gap and innovation. Following Ray (2006), we hypothesized that narrow and large aspirations-gap are not conducive for innovation. The results shown in column 4 of Table 4.7 suggested that when compared to people with moderate aspirations-gap, those with narrow aspirations-gap were more likely to adopt more innovations. This did not seem to be in line with the theory that narrow aspirations-gap offers very little motivation to innovate. While the coefficient for the dummy representing large aspirations-gap had the expected negative sign, it is not statistically significant. We then re-ran the model after controlling for other determinants and only one of the two dummies representing aspirations-gap (i.e., either the narrow or large aspirations-gap), leaving out the remaining as the base category (columns 5 and 6). The results (column 5) again suggested that people with narrow aspirations-gap were more likely to have a higher level of innovativeness by comparison with others. While it is possible that narrow aspirations-gap may induce very little motivation to innovate, it may not induce frustrations, unlike what we would expect from very large aspirations-gap. It may also be the case that the method employed for the construction of the three aspirations-gap categories (i.e., narrow, moderate and large) may have put people in 'wrong' categories. The next specification (column 6), however, returned the expected results; by comparison with others, people with very large aspirations-gap were more likely to demonstrate a low level of innovativeness. Based on Ray (2006) and Genicot and Ray (2014), this could be the result of frustration because the gap may appear too large to close.

Table 4.7. Determinants of farmer innovativeness†

	(1) NEGBIN1	(2) NEGBIN2	(3) CONTFUN1	(4) NEGBIN3	(5) NEGBIN4	(6) NEGBIN5
Low aspirations	-0.22***	-0.10	-0.24			
	(0.07)	(0.08)	(0.41)			
Narrow asp. gap				0.35***	0.36***	
				(0.10)	(0.08)	
Large Asp-gap				-0.01		-0.31***
Other controls	No	Yes	Yes	Yes	Yes	Yes
Village dummies	Yes	Yes	Yes	Yes	Yes	Yes
District dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	377	375	375	`375	375	375
Wald chi2	91.81	107.94	123.55	131.69	131.25	122.05
Log likelihood	-949.76	-930.32	-959.26	-920.23	-920.23	-926.38

†Full results are presented in Table A4. 1 in the appendix. Robust standard errors in parentheses.

* p<0.10, ** p<0.05, *** p<0.01

The results in Table 4.7, columns 4 to 6, may suffer from endogeneity bias, which we could not directly test because of a lack of strong instrumental variables for the two dummies representing aspirations-gap. As an alternative, we employed matching estimators and tested if people with a large aspirations-gap were less likely to innovate by comparison with others. We used propensity score matching and covariate matching estimators described in chapter 2, including kernel matching, nearest neighbor matching (Rosenbaum & Rubin, 1983; Smith & Todd, 2005), and bias-corrected covariate matching (Abadie and Imbens, 2011). The results (Table 4.8)

indicated that individuals with a very large aspirations-gap adopted (1.15/5.01) = 23 to (1.42/5.01) = 28 percent fewer innovations by comparison with the base category (i.e., people with a moderate or narrow aspirations-gap). This result is consistent with the findings presented in Table 4.7, confirming that people with a large aspirations-gap were less innovative.

Table 4.8. The effect of large aspirations-gap on farmer innovativeness†

	(1) Kernel	(2) NN	(3) Bias-corrected NN
ATT	-1.42*	-1.35***	-1.15**
	(0.75)	(0.45)	(0.46)
Average innovation index		5.01	
%change	(-)28	(-)27	(-)23
Observations	375	375	375

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Moving on to other results in Table 4.7, we found that impatience (the preference for receiving rewards sooner), the use of credit[48], and wealth status were all positively and statistically significantly correlated with the innovation index. This implies that eagerness and access to material resources are important to innovation. Household size is negatively associated with the innovation index, a result which we found surprising since most of the innovations that made up the index may actually require more labor to implement. The remoteness of a farmers' cooperative office was negatively correlated with innovativeness, which is in line with expectations because proximity to an office is likely to improve access to information and agricultural inputs.

Result 2: Effect of aspirations-gap on access to or use of fertilizers, improved seed, and herbicides and pesticides and adoption of row-planting techniques

Table 4.9 presents the determinants of access to or use of different technologies at plot level. Out of the four innovation indicators (i.e., the use of improved seed, herbicides/pesticides, fertilizers and the adoption of row planting techniques) that we examined in this part, we found that having narrow/large aspirations-gap was negatively and strongly associated only with the adoption of chemical fertilizers. According to these results (Table 4.9, columns 7 and 8), having narrow/large aspirations-gap decreased the probability of a person using inorganic fertilizers, and the results are robust across specifications. However, since the returns generated through adoption of technologies are quite dependent on the intensity of input use, it might be more meaningful to look at the effect of aspirations-gap on the intensity of innovation use. This is examined in the next section by studying the intensity of inorganic fertilizer use[49] at household level and by crop type.

[48] Only one household in the entire reported credit constraints in the self-assessment. So we controlled for a dummy that represented credit use.

[49] We chose fertilizer use for further investigation only because of space constraints.

Table 4.9. The effect of narrow/large aspirations-gap on the use of improved seed, herbicides/pesticides, fertilizer, and row-planting techniques†

	(1) i.seeds	(2) i.seeds	(3) Row-plant	(4) Row-plant	(5) Herbicides	(6) Herbicides	(7) Fertilizers	(8) Fertilizers
Narrow/large asp.gap	0.45	0.47	0.30	0.22	-0.21	-0.18	-0.88***	-0.75**
	(0.29)	(0.31)	(0.32)	(0.30)	(0.30)	(0.29)	(0.31)	(0.32)
Plot characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Crop type	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dist. to services	No	Yes	No	Yes	No	Yes	No	Yes
District dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
rho	-0.39**	-0.37**	-0.26	-0.24	-0.01**	0.02	0.49**	0.42**
	(0.17)	(0.18)	(0.19)	(0.17)	(0.17)	(0.17)	(0.19)	(0.19)
Wald chi2	559***	596***	708***	734***	618***	656***	343***	375***
Observations	1595	1595	1595	1595	1595	1595	1595	1595

†Full results are presented in Table A4. 2 in the appendix. Robust standard errors in parentheses. * p<0.10,** p<0.05,***p<0.01

We found that plot size and asset holdings were positively and strongly associated with the use of all technology indicators, and the results are robust across various specifications (Table 4.9). This could be because when farmers are faced with new innovations, having larger land holdings may allow them to conduct experiments on at least a portion of their land. This is also true when they are wealthy because wealth serves as a cushion to protect them against innovation risks. Other plot-level characteristics, such as perceived soil quality and distance from residence, did not seem to be important determinants of the use of chemical fertilizers, improved seeds, herbicides and pesticides; and the adoption of row planting techniques. If any, those plots very close to residence, which are likely to be homesteads, are negatively associated with the use of chemical fertilizers. Perhaps, this is because farmers might opt to rather use inputs such as household refuse which are less costly to get but costly to transport to remotely located plots. Further, there was a statistically significant, albeit weak, evidence suggesting that plots which were perceived as having low soil fertility were positively associated with the use of chemical fertilizers, which is in line with expectations as fertilizers are added to improve soil fertility. As Table 4.9 also shows, female-headed households and the age of the household head were positively and negatively associated with use of herbicides/pesticides, respectively. The results also suggested that the household head's education level and household size were positively associated with the use of improved seeds and the adoption of row planting techniques. This is because education is likely to increase a farmer's openness to using new technologies and larger household is advantageous for labor-intensive farming methods, which are still prevalent in the country. The results also suggested that past involvement in technology promotion project seemed to increase a farmer's likelihood of adopting the use of herbicides, pesticides and inorganic fertilizers.

The type of crop also determined the use of inputs and improved practices. Both maize and wheat plots are more likely to be planted with improved seeds; row planting techniques are also more likely to be used in both maize and wheat plots than teff plots (Table 4.9). This may be because both wheat and maize in general give higher yields and also are agronomically easier to manage than teff. Further, in the country, the supply of improved seeds for wheat and maize have always been better than that of teff (see Thijssen et al. (2008) for the volume of production of improved seeds over time and by type of crop in the country). Consequently, farmers may have gained better knowledge of improved varieties of wheat and maize, which might have encouraged their adoption decision. However, by comparison to teff plots, maize plots were found to be negatively and strongly

associated with the use of fertilizers, herbicides and pesticides, while wheat plots in contrast were positively and statistically significantly associated with the use of fertilizers (Table 4.9). Indicators of distance (remoteness) between a household and the agricultural cooperative office, the nearest micro finance institution, and the farmer training center (FTC) were found to be negatively associated with either the use of improved seeds, herbicides and pesticides; or the adoption of row planting techniques. This is in line with expectations as access to inputs, and access to extension and advisory services are likely to be limited when farmers are located farther away from these service centers. However, the remoteness of the nearest input dealer is positively associated with the use of herbicides and pesticides, a result which seems less intuitive.

The results from the switch parts[50] (where a dummy representing either large or narrow aspirations-gap is the dependent variable) of the endogenous switching regression suggested that father's past involvement in a cooperative, larger household size, having low risk aversion, and remoteness of the FTC and the nearest asphalt road were all negatively associated with large or narrow aspirations-gap. Having a female household head, having larger livestock and asset holdings, participation in past technology interventions, and remoteness of the nearest microfinance institution are all positively and significantly associated with large or narrow aspirations-gap (Table 4.9).

Result 3: Effect of aspirations-gap on the intensity of fertilizers use

The choice of adopting an innovation or technology involves a multistage decision-making process (or "hurdle"). Given all other constraints, it is essential to examine the effect of the main variable of interest at each stage. The first-stage analysis have already shown that a narrow or large aspirations-gap is an important determinant of adoption of inorganic fertilizers at plot level (Table 4.9). In this section, we examine if the result holds for the intensity (kg/ha) of fertilizer use. We start by examining if the effect of aspirations-gap varies by type of crop planted.

Result 3.1. Effect of aspirations-gap on the intensity of fertilizer use: by crop type

As presented in Table 4.10, regressions were performed for each crop at household level separately. Except for teff (column 2), we did not find any evidence that suggests that the intensity of fertilizer use was strongly associated with a person's aspirations-gap. Perhaps this is because even though teff in general has a higher market value than wheat and maize, its output per hectare (or yield) is very low by comparison. Further, teff production cost is also higher because it requires more labor time and other complementary inputs. As a result, people who lack motivation in general or who have a narrow or large aspirations-gap may avoid investing too much on this crop. Other factors such as having a female household head and distance to input dealer were found to be negatively associated with the intensity of fertilizer use when the crop is teff (Table 4.10). The results for wheat indicated that farmers who had experienced some negative shocks in the previous 12 months tended

[50] The switch part presents the key determinants of the aspirations status (and aspirations-gap) including those which also determine the adoption of technologies. But the results will not be discussed in detail because identifying determinants of aspirations is not the focus of this chapter.

to use less fertilizers per hectare of land. Further, having larger asset holdings also increased the intensity of fertilizer use on both teff and maize crops.

Table 4.10. Determinants of the intensity of fertilizers use by crop type, household level (aspirations-gap as explanatory variable) †

	(1) Teff1	(2) Teff2	(3) Maize1	(4) Maize2	(5) Wheat1	(6) Wheat2
	OLS	Endog.Te.	OLS	Endog.Te.	OLS	Endog.Te.
Narrow/large asp.gap	-3.03	-67.32**	8.42	14.52	8.22	-13.07
	(9.28)	(30.25)	(10.02)	(36.65)	(14.56)	(20.22)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Wald chi2		260.66***		1762.43***		102.46***
Log lik.	-1165.9	-1140.42	-1308.63	-1275.79	-1203.38	-1167.53
r2	0.53		0.8		0.3	
Observations	220	200	246	223	225	208

†Full results are presented in Table A4. 3 in the appendix. Robust standard errors in parentheses. * p<0.10, ** p<0.05, ***p<0.01

Result 3.2. Effect of aspirations-gap on the intensity of fertilizers use at household level

To get a general picture of the effect of aspirations-gap on total fertilizer use per hectare of land at household level, the data is further examined without taking into account plot characteristics and the types of crop cultivated. The results (Table 4.11) clearly indicate that households with narrow or large aspirations-gap tended to have lower fertilizer use per hectare of land than households with moderate aspirations-gap. According to these results, the average difference in fertilizer use between a household with narrow or large aspirations-gap and that with moderate aspirations-gap was 104-106 kg/ha (columns 2-4). This could also be interpreted as the estimated average treatment effect (ATE) of having a narrow or very large aspirations-gap. In addition, since the 'treatment' variable (i.e., having a narrow or very large aspirations-gap) did not interact with other regressors, the average treatment effect on the treated (ATET) is the same as the ATE (StataCorp, 2013). Further, adding or excluding the households that did not use fertilizers from the analysis did not change the results qualitatively, again confirming the robustness of the findings.[51]

Table 4.11. Determinants of the intensity of fertilizer use, household level†

	(1) Intensity	(2) Intensity	(3) Intensity	(4) Intensity
	OLS	Endog.Te.	Endog.Te.	Endog.Te.
Narrow/large asp-gap	8.11	-104.79***	-105.35***	-106.43***
	(10.81)	(23.86)	(22.09)	(22.26)
Other controls	Yes	Yes	Yes	Yes
Wald chi2		185.03***	187.64***	186.93***
Log lik.	-1983.62	-2102.51	-2100.63	-2100.91
r2	0.38			
Observations	352	352	352	352

†Full results are presented in Table A4. 4 in the appendix. The source of difference among Columns 2-4 is only the type of IVs used in each specification. Robust standard errors in parentheses. * p<0.10, ** p<0.05, ***p<0.01

With regards to other determinants, livestock and total asset holdings were positively and strongly associated with the intensity of fertilizer use. This is in line with expectations because access to credit in rural settings is

[51] Results not reported but available upon request

generally limited, and hence these wealth indicators may not only reflect a person's purchasing power but also serve as collateral when the person takes out a credit agreement. They also contribute to insurance against innovation risks. On the other hand, the amount of land holdings was negatively associated with the intensity of fertilizer use. This could be because the lower yield caused by a lack of intensification (since total output is also determined by the size of cultivated land) may not seem as important to farmers with larger land holdings than to those with smaller land holdings.

Result 4: Correlation of aspirations and other psychosocial indicators

Other internal factors or beliefs such as self-esteem, locus of control, attitude to change, competitiveness or envy, trust in others, subjective well-being, and the perception that poverty is caused by external factors are likely to affect innovation behavior. However, since they are very likely to be linked to each other, it is challenging to find credible identifying instruments to directly examine the potential effect of each of these factors on innovation. Nonetheless, the literature suggests that these factors are strongly correlated with aspirations and targeting them could be a useful policy strategy. This is because "correlation can sometimes provide…evidence of a causal relation" (Angrist and Pischke, 2009: p.197). In this context, an indirect approach was adopted to establish the importance of other psychosocial factors to innovation through their correlation with aspirations. Consequently, the aspirations index was separately regressed on each of these internal factors and other determinants of aspirations (Table 4.12). The results suggested that indicators of self-esteem, trust in others, and subjective well-being are positively and significantly correlated with the level of aspirations. This is consistent with the theory and the results from the descriptive statistics of this study as well as other studies, such as Kosec et al (2012).

Table 4.12. Correlation of aspirations and psychosocial indicators†

	(1) SE	(2) LC	(3) OC	(4) E	(5) T	(6) SW	(7) PP	(8) ALL
Self-esteem	0.17**							0.12
	(0.08)							(0.09)
Locus of control		0.07						-0.10
		(0.11)						(0.12)
Openness to change			0.08					0.06
			(0.06)					(0.07)
Envy				-0.00				-0.01
				(0.03)				(0.03)
Trust					0.09***			0.09***
					(0.03)			(0.03)
Subjective well-being						0.08***		0.09***
						(0.03)		(0.03)
Poverty caused by external factors							-0.13	-0.12
							(0.10)	(0.09)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	375	375	375	375	375	375	375	375
R-squared	0.31	0.29	0.30	0.29	0.31	0.30	0.30	0.33

†Full results are presented in Table A4. 5 in the appendix as. Robust standard errors in parentheses. * p<0.10, ** p<0.05, ***p<0.01

We also made a similar attempt to see the correlation of future expectations with each of the internal traits after controlling for other determinants. As shown in Table 4.13, future expectations were strongly and positively

correlated with self-esteem, internal locus of control, trust in others, and subjective well-being, whereas the perception that poverty is caused by external factors was found to be negatively correlated with future expectations.

Table 4.13. Correlation of expectations and psychosocial indicators†

	(1) SE	(2) LC	(3) OC	(4) E	(5) T	(6) SW	(7) PP	(8) ALL
Self-esteem	0.22***							0.11
	(0.07)							(0.09)
Locus of control		0.26***						0.20**
		(0.08)						(0.10)
Openness to change			-0.05					-0.09
			(0.05)					(0.06)
Envy				-0.03				-0.01
				(0.03)				(0.03)
Trust					0.12***			0.10**
					(0.04)			(0.04)
Subjective well-being						0.08**		0.10***
						(0.04)		(0.04)
Perception on causes of poverty as external							-0.17**	0.01
							(0.07)	(0.09)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	375	375	375	375	375	375	375	375
R-squared	0.38	0.39	0.36	0.36	0.38	0.37	0.37	0.42

†Full results are presented in Table A4. 6 in the appendix. Robust standard errors in parentheses. * p<0.10, ** p<0.05, ***p<0.01

4.6. Conclusions

Beliefs or the sense of control individuals have over their life shape their preferences. An internally constrained person may have low aspirations and hence may not put too much effort into improving their situation. In this study, we used an aggregated index constructed from four indicators that measure aspirations with regards to income, wealth, social status and children's education, as indicator of aspirations. Descriptive statistics suggested that individuals in the poorest income and wealth group and those with less education exhibited low aspirations, strengthening the notion that the poor may lack the resources or the 'capacity' to aspire (Appadurai, 2004). These results were confirmed by regression analyses that controlled for indicators of wealth and other potential determinants of aspirations. We examined whether a narrow or large aspirations-gap determines innovation behavior. We used the adoption of agricultural technologies – such as improved seeds, chemical fertilizers, and herbicides/pesticides – and the adoption of improved planting method (i.e., row planting) as indicators of innovation. We conducted plot-level and household-level analyses and found that having a narrow or very large aspirations-gap was strongly associated with a low level of innovativeness or low adoption of inorganic fertilizers. For example, our estimates suggested that, on average, a household with a narrow or very large aspirations-gap used about 105kg/ha less fertilizers, on average, than an otherwise similar household with moderate level of aspirations-gap.

Results of this study, however, should be interpreted with caution for the following reasons. Fist, aspirations and other cognitive indicators are likely to be measured with error. Yet, attempts were made to minimize the potential influence of the error through standardization of the data. Secondly, the method employed for the construction of the three aspirations-gap categories (i.e., narrow, moderate and large) may have put people in 'wrong' categories. Various specifications were tried to find robust results and thus accounting for this issue. Further, the data was collected from study sites which have high agricultural potential. This may limit the external validity of the study. However, most of the findings in this study are in line with the theory which suggests that moderate aspirations motivate future-oriented behavior. Our findings are also in line with a few other empirical studies such as Bernard et al. (2014) and Ghosal et al. (2013), which found that aspirations have strong impact on savings, increased demand for credit and other forward-looking behavior. Despite the highly endogenous nature of aspirations – our main variable of interest – and hence corresponding challenges of finding powerful instrumental variables in observational studies, this study, to our knowledge, is the first attempt at providing empirical evidence using multiple innovations in the context of agriculture. Our findings clearly demonstrated that beyond access to material resources, psychological factors such as aspirations may also play a role in the adoption of agricultural innovations in rural Ethiopia.

5. ASPIRATIONS AND INCOME, FOOD SECURITY AND SUBJECTIVE WELL-BEING IN RURAL ETHIOPIA

Abstract

Despite some improvements in recent years, poverty and food insecurity remain widespread and main challenges in Ethiopia. Much of the empirical literature focus on identifying resource related constraints with little attention to 'internal' or psychological factors such as aspirations. Using individual and household level data collected in rural Ethiopia, we examine if aspirations are strongly associated with well-being outcomes, as posited in the aspirations failure framework articulated by Ray (2006) and others. We employ both bivariate and multivariate analyses. We find that aspirations (particularly that of the household head) are indeed strongly associated with the household per-capita income and expenditure and various triangulating measures of household food (in)security including per-capita calorie consumption, food consumption score (FCS), household dietary diversity score (HDDS), and household food insecurity access scale (HFIAS). Contrary to few other studies, we also find strong evidence that aspirations are positively associated with satisfaction in life and/or happiness in rural Ethiopia. Findings in this Chapter provide suggestive evidence that policies aimed at improving the well-being outcomes might benefit if they incorporate aspirations raising strategies.

Key words: Aspirations, income, poverty, food security, subjective well-being, Ethiopia

5.1. Introduction

Despite some improvements in recent years, poverty and food insecurity remain widespread and the main challenges in Ethiopia. These challenges are further exacerbated by climatic shocks such as the failure of rainfall which adversely affect agriculture and allied activities, the main sources of livelihoods for the rural population[52]. In fact, following the failure of rainfall during the 2015 agricultural seasons, estimates suggest that about 10.1 million people require emergency food assistance as of December 2015 (EHRD, 2016). Poverty persistence had long been recognised as a major contributing factor for the continuing vulnerability of the food insecure group and this has led the government, jointly with development partners, to implement a social safety net program (PSNP) since 2005. This program aims at smoothing consumption, reducing risks the poor face and protecting their assets (GFDRE, 2009). In 2012, the PSNP reached over 7.6 million people and the program is complemented by a household asset building program (HABP) which provides food insecure households with financial services and technical support to strengthen their production systems by diversifying income sources, and increasing productive assets so as to improve their productivity (World Bank, 2013).

[52] According to the Central Statistics Agency of Ethiopia (CSA), the rural population is estimated to constitute about 83 percent of the total which is estimated at 87,952, 000 as of July 2014. http://www.csa.gov.et/ (accessed Nov 17, 2015).

Notwithstanding the potential benefits associated with policies such as the PSNP, the alleged benefits would be realized only under a set of conditions. For example, the recent weather related shocks highlight the level of vulnerability of the poor despite such programs. In addition, while earlier evaluations of the PSNP (e.g. Gilligan et al., 2009; Berhane et al., 2011, 2014; Coll-Black et al., 2011) find some positive impact of the program on food security, asset holdings and income growth, there is little evidence of graduation[53]. These studies attribute the lack of graduation, among others, to limited efficiency in program implementation, higher food prices and the nature of the program targeting households which are both poor and food insecure. Yet, what is missing in these studies as well as the broader empirical literature on the determinants of well-being outcomes is the importance of psychological factors or 'internal' constraints, such as lack of aspirations. As discussed in the preceding chapters, however, internal constraints are also important for they could reinforce external constraints (or material deprivations) and this may lead to a self-sustaining trap of low-aspirations, poverty and food insecurity. In this context, we study the effect of aspirations on income, food security and subjective well-being in rural Ethiopia.

The next section presents the background and review of related literature followed by section 5.3 which presents the data and descriptive statistics. The empirical strategy and results are discussed in section 5.4 and section 5.5 concludes the Chapter.

5.2. Background and literature review

5.2.1. Some concepts and measurements of poverty and food insecurity

The literature on the determinants of poverty and food insecurity continues to grow for a significant proportion of the world population still suffers from such deprivations. Sen's (1976, 1981) seminal studies respectively on poverty measurement and poverty and famines have inspired the development of more analytical tools such as the aspirations-failure framework and the improvement of the measurements of poverty, food insecurity, and other well-being outcomes. The Alkire and Foster (2011, 2009) multidimensional poverty index (MPI) is the latest entrant to the list of measurements of poverty. The MPI encompasses the many deprivations that people can experience across different areas of their lives including lack of education or employment, inadequate housing, poor health and nutrition, low personal security, or social isolation. According to Alkire and Foster (2009, 2011) the MPI is a powerful tool to show how and where people are poor, within and across countries and regions. Consequently, the MPI has been adopted as a target indicator for monitoring the UN sustainable development goals.[54] Yet, composite measures such as the MPI are not without critics.[55] For example, Ravallion

[53] "Graduation" is a situation where a household can meet its food needs for all 12 months and is able to withstand modest shocks in the absence of the PSNP (GFDRE, 2007; p.2)
[54] http://www.ophi.org.uk/multidimensional-poverty-index-adopted-as-a-sdg-target-indicator/ (accessed Nov 26, 2015)
[55] To read the debates regarding the MPI, refer to the world bank blog on this link:
http://blogs.worldbank.org/africacan/the-multidimensional-poverty-index-debate-rounds-2-3-4 (accessed Nov 26, 2015)

(1996, 2010[56]) argues that the "welfare rankings of social states (including policies) based on composite measures [such as the MPI] will often be more difficult." For this or other reasons, much of the empirical studies on poverty to a large extent rely on unidimensional poverty measures, often following Foster, Greer and Thorbecke (1984). In such approach, only monetary dimensions are used and the poor are identified as those whose expenditure (or income) falls below a defined poverty line which is often determined by the income required to achieve the minimum caloric requirements (Haughton and Khandker, 2009). Three methods are used to calculate the poverty line, including *direct caloric intake, subjective poverty lines,* and *the cost of basic needs.* According to Haughton and Khandker (2009), *the cost of basic needs* estimates the cost of acquiring enough food for adequate nutrition and then adds the cost of other essentials such as clothing and shelter. The *food energy intake* method can be used as the next option in the absence of price information. To determine the expenditure (or income) level at which a household acquires enough food, the method plots expenditure (or income) per capita against food consumption (in calories per person per day). On the other hand, by asking people the minimum income level that is needed just to make ends meet, *subjective poverty lines* are calculated (Haughton and Khandker, 2009).

The most commonly used method, among the three, is the *cost of basic needs* approach (Haughton and Khandker, 2009). Further, it is argued that poverty measurements based on consumption expenditure are preferred to income for the measurement is more accurate in the case of consumption expenditure and also it is subject to less temporal variations which is often the case for income, particularly in developing countries (see review by Deaton and Grosh, 1998). In some cases, a slightly modified form of these indicators (e.g. share of food expenditure by the poor) (Jones et al., 2013) are used to measure food security even though poverty is commonly considered as one of the main determinants (Barrett, 2010). However, food security is a rather complex concept and its definition continues to evolve. The latest definition that refined the one adopted in the 1996 World Food Summit states that "food security (is) a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2002). According to Jones et al (2013), this definition addresses concerns related to: inequitable distribution of food not only within countries but also within households, the ability to acquire socially and culturally acceptable food and the ways in which to acquire it, and the food composition and micro nutrient requirements. Food insecurity on the other hand is a state "when people do not have adequate physical, social or economic access to food" as defined above (FAO, 2002).

To operationalize the definition of food (in)security, empirical studies often use one or some combination of the four domains that reflect: food availability, access, utilization, and the stability of food over time. Yet, the complexity of the concept is simply evident from the availability of multiple approaches and tools for assessing food security. For example, in some cases, the concept of food insecurity is used interchangeably with nutrition insecurity even though nutrition security requires food security along with "care, health and hygiene practices" (Jones et al, 2013). A related concept often used to measure food and nutrition insecurity is undernutrition,

[56] https://oxfamblogs.org/fp2p/guest-blog-world-bank-research-director-critiques-the-new-un-poverty-index/ (accessed November 26, 2015)

which is "caused by undernourishment –defined as a level of food intake insufficient to meet dietary energy requirements" (FAO, IFAD and WFP, 2015). In the same report, hunger is defined as synonymous with chronic undernourishment. This simply shows that the concepts are overlapping (Jones et al, 2013, see Figure 5.1), and hence a diverse pool of food and nutrition security measurements exist. Based on a systematic review of available measurements, Jones et al (2013) and Pangaribowo et al. (2013) argue that the choice of which measurement to use requires understanding the underlying constructs and identifying the intended use of a tool (or the intended use of the data to be collected).

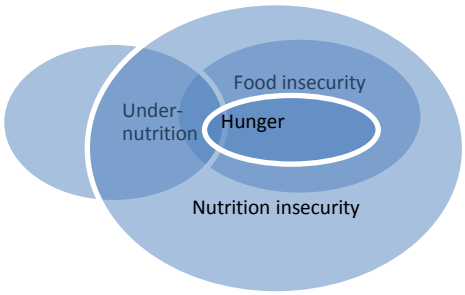


Figure 5.1. Overlapping concepts within the context of food and nutrition security.

(The figure is from Jones et al (2013) who adapted it from Benson (2004). Used with permission from the International Food Policy Research Institute. The more elaborated version can be referred to Benson (2004)).

5.2.2. Empirical evidence on the state of poverty and its determinants

The share of world population living under $1.90 or less per-day, a new international poverty line using the 2011 purchasing power parity (PPP), is estimated to be 700 million (or 9.6 percent of the world's population) in 2015 (World Bank Group, 2016). Based on data from 2011, the same report predicts that the poverty rate in Ethiopia would be 33 percent in 2015. On the other hand, based on the national poverty line measured at 2010/11 prices, official reports show that the incidence of poverty in the country was 29.6 percent in 2011, a decline from 38.7 percent in 2004/05 (MOFED, 2013). While this shows a significant improvement over the years, poverty remains a priority policy concern in Ethiopia. Various studies examine the correlates of poverty and poverty dynamics in rural Ethiopia. Based on a panel household survey data (ERHS) from 15 rural villages in Ethiopia, some studies find a statistically significant poverty reducing effects of access to: roads and towns (Dercon and Krishnan, 1998; Dercon et al, 2009; and Dercon et al, 2012), agricultural extension services (Dercon et al, 2012 and Dercon et al, 2009) and human and physical capital such as better education, male headship of the household and relatively being younger, land and oxen (Dercon and Krishnan., 1998). While results from these studies are based on data collected from same households repeatedly interviewed (six times) between 1989 and 2004, the number of waves used in each study is not necessarily the same. Yet, similar findings were also reported by Bogale et al. (2005) who used a three-round survey data other than the ERHS. Bogale et al (2005) study the determinants of rural poverty in three rural villages in Ethiopia. They find that rural poverty is strongly linked to access to land, human capital and oxen. Similarly, Dercon, (2006) analyses the determinants of growth

and poverty changes between 1989 and 1995. He finds that location, land and labor endowment are important factors for the observed differences in terms of some changes and poverty persistence. Similar results are also reported by Bigsten et al.(2003) that also identify the importance of growing cash crop (*Chat*) for the improvement of household welfare. Bigsten and Shimeles (2008) also analyse the persistence of poverty in both rural and urban areas in Ethiopia during 1994-2004. They find that households move frequently in and out of poverty. Their findings suggest that the difficulty of exiting from poverty increases with the time spent in that state and varies considerably between male and female headed households.

Rural households in Ethiopia are highly vulnerable to weather and idiosyncratic shocks for their livelihoods depend on subsistence agriculture and related sectors such as pastoralism. For example, an earlier study by von Braun (1991) reports that a 10% decline in rainfall below the long-term national average causes national cereal production to decline by 4.4%. A more recent study by Porter (2012) also finds that extreme low rainfall relative to local norms can cause significant reductions in farm income, and also on consumption whose reduction amounts to 20%for people in the bottom quintile of the local distribution. This is in line with Börner et al (2014) who, based on data from 25 developing countries, find that climate-related shocks predominantly result in reduced consumption.

Ethiopia is arguably one of the most famine-prone countries with a long history of famines and food shortages (see for example Webb and von Braun, 1994) and such type of shortfalls are likely to occur more frequently with the change in climate and this may severely affect the rural poor. In fact, the failure of rainfall in the recent past is revealing the level of vulnerability of the rural people[57] despite the massive social safety net programs that have been put in place since the mid-2000s. Further, shocks of this nature may have a long-lasting impact on the welfare of the people, as a previous study shows (Dercon et al, 2005). Using the two waves of the ERHS data (i.e.1999 and 2004), Dercon et al (2005) show that experiencing a drought at least once in the previous five years lowers per capita consumption by about 20%, and experiencing an illness reduces per capita consumption by approximately 9%. Dercon and Krishnan (2000a) also report finding evidence on the sensitivity of consumption for various shocks in rural Ethiopia. Although other studies such as Asfaw and Braun (2004), Porter (2012) and Yilma et al. (2014) report that consumption is unaffected by health shocks in rural Ethiopia, coping mechanisms in general may include sale of productive assets such as oxen, which might limit the future productivity of the household and that eventually might lead to poverty (or poverty persistence) as discussed above. In line with this, Börner et al (2014) report that households tend to deplete financial and durable assets in response to death or illness or asset-related idiosyncratic shocks. Their study finds that households in sites characterised by high asset wealth tend to cope with shocks in a more proactive way than those in sites with average or below average asset wealth. Yet, the authors note that the role of asset types in conditioning shock responses varies across regions. As another indirect mechanism, weather related shocks may perpetuate poverty through their effect on risk aversion behavior for farmers tend to smooth their consumption by avoiding the use of risky productive inputs such as fertilizers. In this context, using ERHS data, Dercon and Christiaensen (2011) show that some farmers

[57] Recall that an estimated 10.1 million people are reported to be in need of emergency food assistance as of December 2015

are trapped in "low return, lower risk" agriculture, a recipe for the perpetuation of poverty. In the absence of "effective" social safety net programs, this in turn might lead to food insecurity. In fact, based on ERHS data, Dercon and Krishnan, (2000b) find that the body mass index, a widely used indicator of FNS, of adults in poor households in rural Ethiopia are affected by idiosyncratic agricultural shocks, while richer households are more successful in smoothing nutritional levels.

5.2.3. Empirical evidence on the state of food (in)security and their determinants

The latest report on the *State of Food Insecurity in the World* (FAO, IFAD and WFP, 2015) estimates the number of people undernourished in 2014-16 at 795 million or 10.9 percent of the total, a reduction from 18.6 percent in 1990-92. The report notes that the vast majority of the hungry (780 million people) live in the developing world and the overall share of the hungry currently stands at 12.9 percent of the total population. The same report estimates that the share of people in Ethiopia who are undernourished in 2014-16 is 32 percent, a reduction from 74.8 percent in 1990-92. According to the report, this improvement in Ethiopia could be attributed to several interlinked factors including the high GDP growth rate the country has been experiencing in the recent years and the existing social protection program. This assertion echoes other studies such as the World Bank (2015b), Berhane et al (2011, 2014) and Dorosh and Rashid (2012). According to World Bank (2015b), for example, real GDP growth in the country averaged 10.9 percent between 2004 and 2014 and a significant part of this growth comes from agriculture. If this is indeed the case, the reduction in the number of undernourished may not be surprising for the majority of the people in Ethiopia depend on agriculture, a sector which had been found to have a high growth poverty elasticity (e.g. Christiaensen and Demery, 2007; Tafesse, 2005), and poverty is arguably one of the determinants of food and nutrition security. Tafesse (2005), for example, estimates that a one percentage increase in agricultural per capita value added in Ethiopia would result into a one percent decline in poverty level of rural households. Similarly, based on data from Ethiopia and other African countries, Christiaensen and Demery (2007) report that agricultural growth has a high poverty reducing effects.

On the other hand, Berhane et al (2011) evaluate the impact of the PSNP implementation from 2006-2010 on the livelihoods of participating households. They find that, on average, program participation has improved food security by over one month and increased meals eaten by children by 0.15. They also find that five years participation in the program raised livestock holdings by 0.38 tropical livestock units by comparison to receipt of payments in only one year. However, Berhane et al (2011) find limited impact of the program in terms of graduation of beneficiaries from the program. Yet, it is argued that, the establishment of the productive safety net program along with other policy measures (such as substantial liberalization of markets, investment in agricultural research and extension, building of key transport infrastructure) is credited to the prevention of large-scale country wide famines such as those in 1972-1974 and 1984-1985 (Dorosh and Rashid, 2012).

As the concept of FNS evolves, rigorous and national level studies on the determinants of food and nutrition security in Ethiopia are largely lacking. A brief review of available studies which are mainly limited to smaller

geographic areas and often associated with project evaluations, shed some light regarding one or the other domains of food security. In this context, Asenso-Okyere et al.(2013), for example, study the determinants of food security in selected agro-pastoral communities in south-eastern Ethiopia. Using availability of food in the household as proxy indicator to food security, they find that the most significant factors affecting household food security are educational level of the spouse and that of the household head, size of farm land, availability of household assets including livestock, peace and security. Beside household endowments such as land (Feleke et al, 2005) and proximity to food markets (Abay and Hirvonen, 2016), Negatu (2004) reports that livelihood diversification strategies such as livestock rearing, growing cash crops, and engagement in trading are important factors for achieving household food security.

Just like poverty, food insecurity is also affected by seasonality or by irregular shocks such as weather events, deaths or conflicts (Barret, 2010) and hence food insecurity may be chronic or transitory depending on the frequency of such shocks (Jones et al, 2013). According to Jones et al (2013), in response to temporary shocks, households may resort to the sale of assets and other coping strategies which may in turn lead to more sever shocks, failed returns on investments, and an eventual fall into a state of chronic food insecurity. In the event of such shocks, food aid through different modalities is the often used policy response. In this context, a few studies examine the importance of food aid programs following drought or harvest failures on food security in Ethiopia (e.g. Yamano et al., 2005; Quisumbing, 2003; and Gilligan and Hoddinott, 2007). These studies find positive impact of such transfers on consumption or child nutrition outcomes, but Gilligan and Hoddinott (2007) also uncover some evidence of food aid dependency. In addition, even the achieved positive effects are considered to be short term as the country continues to suffer from food insecurity even in good harvest years (Clay et al, 1999). It is this realization that led to the policy shift from such "ad hoc responses" to the more planned and systematic approach of the PSNP (GFDRE, 2009).

To sum up, the presence of widespread food insecurity in Ethiopia is argued to be the result of several factors including recurrent drought and heavy reliance on nature, use of backward agricultural technologies (or low input –low output production systems), and inappropriate agricultural policies in the past (Devereux, 2000). Relatedly, von Braun and Olofinbiyi (2007) more broadly classify the major factors of food crisis in the country as: population pressure, production failures, marketing failures, and policy, institutional, and organizational failures. However, what might be an important determinant and yet largely ignored in the studies reviewed here or more generally from the broader empirical literature on poverty and food insecurity is the role of internal factors, specifically aspirations. This study contributes to filling the gap in the literature.

5.3. Data and descriptive statistics

5.3.1. Data

The study is based on a household survey data collected from rural households in Ethiopia. The sampling method and measurement issues regarding aspirations are fully described in chapter two. But in general, the study is based on 379 farm households who reside in three study sites. The survey collected information on

individual aspirations and future expectations using four indicators: income, wealth, social status and children's education. Using these four indicators, an aggregate aspirations index is calculated using the formula described in chapter 2. Further, the aggregate aspirations index is used to classify individuals into low-aspirations and high-aspirations status by comparison to the district average. The survey also collected information on other individual as well as household level information including income, assets, consumption expenditure, food security and other indicators of well-being.

5.3.2. Descriptive statistics

5.3.2.1. Income and wealth

We begin with the descriptive statistics on income and wealth indicators to show how the sample households have fared over time (2006-2014). Table 5.1 provides the (per-capita) mean and median annual income of the study households by source of income. The data suggest that the per-capita annual income has improved between 2006 and 2014 for each income source except for livestock income, and for income from all sources combined. The total per-capita income has grown by about 27 percent during the same period and the difference between the means of per-capita income in 2006 and 2014 is statistically significant. Table 2 also suggests that the number of households with off-farm income has increased between 2006 and 2014. Similarly, Table 5.2 shows that, on average, the total value of assets owned by households have increased during the specified period. The value of livestock holdings take the lion's share in the value of total asset holdings, and its significant decline in 2010 seems to fully explain the total decline in the total value of assets for that year.

Table 5.1. Annual household income by source (Ethiopian Birr, at 2006 constant terms).

	2006			2010			2014		
Source	N	Mean	Median	N	Mean	Median	N	Mean	Median
Livestock income	295	3172	1609	328	2924	1326	329	2303	1288
Crop income	387	12128	9886	383	13873	11425	376	14788	10489
Agricultural income	**390**	**14434**	**11562**	**384**	**16334**	**13787**	**377**	**16758**	**12134**
Business and wage labor	164	3190	942	227	2562	1236	185	4797	1795
Transfers income	5	1840	300	28	1169	562	81	2047	1077
Off-farm income	**168**	**3169**	**942**	**236**	**2603**	**1273**	**230**	**4579**	**1843**
Total income	**390**	**15799**	**12296**	**384**	**17935**	**14974**	**379**	**19449**	**13848**
Total income per-capita	***390***	***2290***	***1794***	***384***	***2596***	***2182***	***379***	***2899***	***2122***

Note: t-test mean comparisons show that differences are significant at the 1% level for total income (2006/2010, 2006/2014 and 2010/2014), agricultural income (2006/2010 and 2006/2014) and off-farm income (2010/2014). Other differences in these categories are not statistically significant.

Table 5.2. Total value of assets[58] owned by the HH (in ETH Birr) at 2006 constant terms

	2006 (n=386)		2010 (n=384)		2014 (n=379)	
	Mean	Median	Mean	Median	Mean	Median
Value of production assets	403	100	963	129	1,743	455
Value of consumer durables	934	234	959	392	2,359	788
Value of livestock	10,273	7,865	5,752	4,413	14,969	10,630
Total value of assets	***11,611***	***9,127***	***7,674***	***5,977***	***19,071***	***14,089***

[58] Production assets, consumer durables, and livestock holdings were used to calculate household wealth or total value of household assets

Since the data on aspirations is available only for the 2014 survey, we could not show if there was any correlated trend between aspirations and income or wealth indicators over time. Yet, as we presented in chapter 2, descriptive statistics for the 2014 data suggest that aspirations increase with age, education, and wealth status. Further, we conduct mean comparisons across indicators including annual household income per adult equivalent, monthly per capita expenditure, and value of asset holdings between people with different levels of aspirations. According to Table 5.3, individuals with high aspirations have on average higher income or wealth by comparison to those with low aspirations and the difference is statistically significant at less than 1 percent (with the only exception of per-capita expenditure for spouses with low and high aspirations). These descriptive statistics in general reflect preliminary evidence suggesting that aspirations could be one of the strong correlates of poverty (or income) as the theory predicts.

Table 5.3. Mean comparison of the 2014 household income and wealth (in ETB) by aspirations level of the spouse and head of the household

	Household head			Spouse		
	Mean outcome (High Asp.)	Mean outcome (Low Asp.)	*Mean difference: p-value*	Mean outcome (High Asp.)	Mean outcome (Low Asp.)	*Mean difference: p-value*
Total annual income per-adult equivalent	12453	8170	*0.0001*	14167	9825	*0.0003*
Monthly per-capita consumption expenditure	593	506	*0.0051*	572	542	*0.3734*
Total value of assets	77662	39991	*0.0000*	89702	59822	*0.0008*

5.3.2.2. Food Security

Food security, as discussed in the literature review, is a broad and complex concept and we try to capture its multidimensionality (i.e. availability, access, utilization and stability) by employing widely used indicators. We construct triangulating measures of food (in)security including per-capita calorie consumption, food consumption score (FCS), household dietary diversity score (HDDS), household food insecurity access scale (HFIAS), and the incidence of inadequate food supply in the household in the previous 12 months. We capture intra-household food allocations based on the information we collected by asking whether all household members eat the same diet, and whether each of them eats more- or less- diversified diet and how many times a day, by age categories.

The measurement of food consumption using kilocalories (such as per-capita calorie consumption) is referred to as the "gold standard" to measure food security but its implementation is challenging for it requires the collection of detailed food intake data which is time consuming (WFP, 2008). This study however benefits from the availability of such information in the data, which also helps triangulate the result from other indicators. One of the alternative tools to measuring food security is the WFP's (2008) FCS that measures the frequency of consumption of different food groups consumed by a household during the 7 days before the survey. In this approach, different food items are first categorized into 9 main groups and a food consumption score is then

calculated using weights assigned to each food group.[59] Using the recommended FCS cut-offs which had been validated based on data collected from households in different countries (e.g. Wiesmann et al, 2009), this technique categorises households into three food security groups: *poor, borderline and acceptable*.

A related composite measure is the HDDS, which reflects the average household dietary diversity and proxies for household food access (Swindle and Bilinsky, 2006). HDDS differs from FCS for it does not attach any weight among different food items and also does not take into account the frequency of consumption of a certain food. Further, it often uses a 24-hour recall period which is shorter than the seven-days recall used in the FCS. The average HDDS is calculated based on whether anyone in the household consumed any of the 12 types of food groups.[60] To examine household food access, the resulting HDDS is compared among income groups such as income-terciles.

On the other hand, household food insecurity could also be measured using HFIAS, which captures the household's food insecurity (in terms of access), including the frequency of occurrence of the event in the 4 weeks prior to the survey (Coates et al, 2007). In this measure, three dimensions of occurrence of food insecurity are captured: "anxiety and uncertainty about the household food supply; insufficient quality (includes variety and preferences of the type of food); and, insufficient food intake and its physical consequences" (Coates et al, 2007: p.6). The HFIAS is then calculated by summing over the frequency-of-occurrence of food insecurity-related conditions with higher value indicating severe food insecurity. Following the recommended cut-offs (Coates et al, 2007), households are then categorised into 4 levels of household food insecurity: *food secure, mild, moderately* and *severely food insecure*. Next, we provide empirical evidence on the level of household food (in)security among the study households using the indicators discussed above.

To begin with, based on the direct responses by the household head (and/or the spouse), the data suggest that only about 7 percent of households had a situation where the household did not have enough food in the previous 12 months. In terms of intra-household food allocations, under-five children had, on average, 4 meals per-day by comparison to 3 meals eaten by other household members. Further, about 83 percent of households reported that all household members eat roughly the same diet while the remaining report that children eat more diverse foods.

Based on the recommended cut-offs for the food (in)security measurements such as the FCS and HFIAS, the data suggest that the share of households in the sample who are food insecure are between 7 and 10 percent (See

[59] The 9 main food groups and the given corresponding weights (in parenthesis) include- Main staples: cereals, starchy tubers and roots (2); Pulses: legumes and nuts (3); Meat and fish: beef, goat, poultry, pork, eggs and fish (4); Vegetables (including green leaves) (1); Fruits (1); Oil: oils, fats and butter (0.5); Milk: milk, yogurt and other diary (4); and Sugar: sugar and sugar products, honey (0.5). For details including calculation steps, see WFP's (2008).

[60] These food groups include: cereals; root and tubers; vegetables; fruits; meat, poultry offal; eggs; fish and sea food; pulses/legumes/nuts; milk and milk products; Oil/fats; Sugar/honey; miscellaneous. HDDS is then calculated following Swindale and Bilinsky (2006)

Table 5.4 and Table 5.5). However, when we investigate calorie consumption using the 2,100 kilocalories[61] per person and day dietary energy requirement, the share of households that can be considered food insecure increases to 27 percent (Table 5.6). Further disaggregation of the data by calorie consumption thresholds reveal that households who are considered greatly food insecure (<1470 kcal) and those on the borderline (≥ 1,470 and < 2,100 kcal) are about 6 percent and 21 percent, respectively (Table 5.6).

These figures may seem a great underestimation of the level of food insecurity by the country standard since FAO, IFAD and WFP's (2014) estimate puts the share people undernourished in 2012-2014 at 35 percent. However, we offer two reasons for our results: (1) our sample households were drawn from relatively well-off districts in terms of average land holdings and agricultural potential, and (2) data were collected immediately after harvest. These two factors may tend to overemphasize the availability of food in the sample households. Nonetheless, availability of food does not necessarily guarantee access to- and utilisation of- food and by extension overall food security. To capture the household's food access, we cross tabulate one measure of diet quality (HDDS) against per-capita food expenditure terciles. According to Figure 5.2, the average diet diversity increases with the increase in expenditure. Further, consumption of food groups such as fruits, meats, and eggs greatly vary by income group with progressive increase. For example, the share of households that consume fruits, meats, and eggs for the lowest expenditure group is 13%, 21%, and 33%, respectively while the corresponding figures for each food group by the middle expenditure group are roughly twice, and that by the top expenditure group are roughly thrice.

Finally, we triangulate relations among our different indicators. Pairwise correlation of per-capita calorie consumption, FCS, HDDS, HFIAS and per-capita food expenditure suggests that all except HFIAS score are statistically significantly correlated to each other (i.e. $p<0.01$) (Table 5.7). Note however that since households draw their calories mainly from cereals, the correlation coefficients of FCS and HDDS with per-capita calorie consumption are relatively low (i.e. less than 0.3). Yet, as expected, there is a high correlation coefficient between FCS and HDDS since both indicators reflect the diversity of foods consumed. HFIAS score is also statistically significantly correlated with FCS and per-capita food expenditure (i.e. at $p<0.1$ and $p<0.05$ respectively), though the correlation is low. The latter can be explained by the different nature of the self-reported HFIAS, which may also reflect tastes, preferences and traditions.

[61] The cut-off point, as the minimum caloric requirement, used by official reports in Ethiopia is 2200 kilocalories (See MOFED, 2013). If we were to use that cut off point, the number of food insecure groups would rise to 32 percent. However, we use 2100 kcal cut-off to keep consistency with the internationally used measures and in line with other indicators employed in this study.

Table 5.4. Households by food consumption score (FCS)[62] profile

	Freq.	Percent	% with low-aspirations within each food (in)security profile	
FCS profile			Head	Spouse*
Poor (FCS<=28)	3	0.79	33	100
Borderline (28.5<= FCS<=42)	24	6.35	58	71
Acceptable (FCS<=42)	351	92.86	31	64

*Note: Corresponding statistics does not include female headed households.

Table 5.5. Households by household food insecurity access scale (HFIAS) profile[63]

	Freq.	Percent	% with low-aspirations within each food (in)security profile	
HFIAS category			Head	Spouse*
Food secure	340	90.19	30	64
Mildly food insecure	9	2.39	78	40
Moderately food insecure	21	5.57	43	83
Severely food insecure	7	1.86	71	67

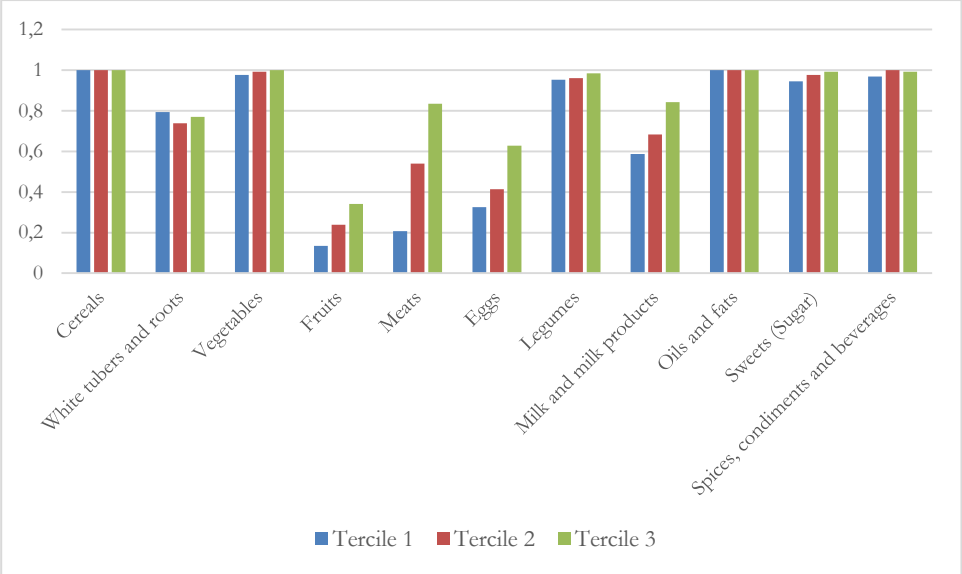
*Note: Corresponding statistics does not include female headed households.

Table 5.6. Households by per-capita calorie consumption profile[64]

	Freq.	Percent	% with low-aspirations within each food (in)security profile	
Calorie consumption thresholds			Head	Spouse*
Poor (<1470 kcal)	21	5.56	38	67
Borderline (≥ 1,470 – < 2,100 kcal)	82	21.69	38	61
Acceptable (>=2100 kcal)	275	72.75	31	67

*Note: Corresponding statistics does not include female headed households.

Figure 5.2. Dietary diversity score (HDDS) by per-capita consumption expenditure terciles



[62] FCS thresholds constructed following Wiesmann et al (2009).
[63] Household Food Insecurity Access category was determined following Coates et al (2007).
[64] The calorie value of foods consumed in the household was calculated using FAO's calorie conversion factors. calorie/gmhttp://www.fao.org/docrep/003/X6877E/X6877E20.htm. Calorie consumption thresholds are based on Wiesmann et al (2009).

Table 5.7. Pairwise correlation of various food (in)security indicators

	Per-capita calorie consumption per day	FCS	HDDS	HFIAS score	Per-capita monthly food expenditure
Per-capita calorie consumption per day	1				
FCS	0.2658***	1			
HDDS	0.2305***	0.7294***	1		
HFIAS score	-0.104	-0.1356*	-0.1295	1	
Per-capita monthly food expenditure	0.7618***	0.4392***	0.3903***	-0.1634**	1

* p<0.10, ** p<0.05, *** p<0.01

One of the preliminary approaches to see the possible links between household food security and aspirations is to examine the share of people with low-aspirations that belongs in each food (in)security profile across indicators. Accordingly, Table 5.4 to Table 5.6 present such descriptive statistics, differentiated by the aspirations of the household heads and spouses.[65] For example, Table 5.5 shows that, among households who are considered "severely food insecure", the share of household heads with low aspirations is 71 percent while the corresponding figure for spouses is 67 percent. Further, spouses with low aspirations account for more than 50 percent of all spouses in households which are considered "food insecure" and this is the case for almost all indicators (Table 5.4 to Table 5.6). While the large proportion of household heads that belong in households which are "food insecure" seem to have low aspirations, there is no clear trend across various indicators. In general, these preliminary evidences imply that it may be useful to control for the aspirations of both the household head and spouse while studying food security correlates using multivariate analysis.

5.3.2.3. Subjective well-being

Any effort that a household puts for the betterment of its economic outcomes such as income, wealth or food security may partly depend on the perception it holds regarding its well-being by comparison to others or by comparison to own past outcomes. In this context Stark et al (2015), for example, theoretically show that when other unemployed people constitute the main reference group for an individual, this may reduce motivation and hence give rise to a "culture of unemployment." From a policy perspective satisfaction in life, happiness or subjective well-being in a society could also be an end in its own right,[66] not to mention the availability of empirical evidence on the positive effects of, for example, happiness on - productivity (Oswald et al, 2014) and economic growth through life expectancy and investment (Li and Lu, 2008). In this section, we present descriptive statistics on the subjective well-being of the study households using various indicators. Availability of data for some of these indicators in the previous surveys (i.e. in 2006 and in 2010) allows us to see the average change in subjective well-being between 2006 and 2014. First, in all three surveys, the heads of households were asked about their household's welfare by comparison to other households in the village. According to Figure

[65] We focus on FCS, HFIAS and per capita calorie consumption because (a) Per-capita food expenditure is not used as a FS measure in this study but as an indirect measure of food access and (b) the HDDS does not have standard cut-offs and is best used in relation to other indicators.

[66] This is because, according to Helliwell et al (2012), happiness, for example, *offers important information about the society: it can signal underlying crises or hidden strengths and it can suggest the need for change*. Further, cognizant of the limitations of other well-being indicators such as income, the study on happiness or life satisfaction has received increased attention in recent years. Recent developments on larger scale for example include OECD's *better life initiative* (OECD, 2011, 2013) and World Happiness Report (Helliwell et al, 2012).

5.3a, about 72% of households in 2006 thought their household's well-being was not different from other households' in the same village. But their share has declined to 59% and then to 53% in 2010 and 2014, respectively. In contrast, the share of those who thought either they were "better than" or "worse than" others has increased over the years and the highest increase comes from those who thought they were "worse than others".

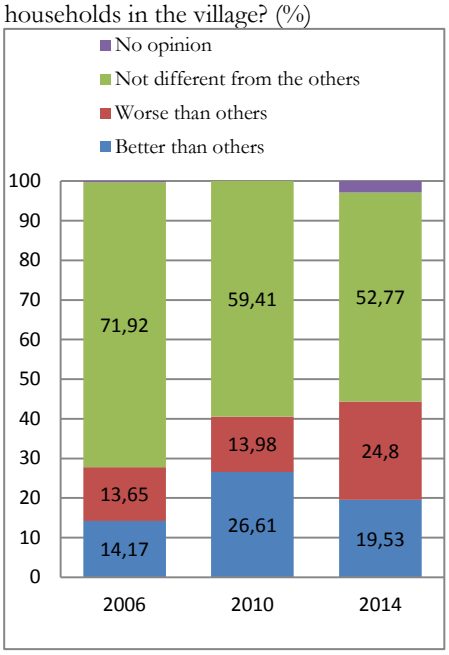
Secondly, without reference to other households, the latest survey (i.e. the 2014) asked household heads two questions about (a) their own assessment of their household's current situation (i.e. well-being), and (b) the change in the well-being of their household in the previous five years. In response to the first question, about 40% of the households thought that they were "rich" or "comfortable" and about 50% of households thought that they "can manage to get by" (Figure 5.3b). Only about 3% of households thought that they were "poor" or "never had quite enough", and none reported to be "destitute." In terms of change in well-being in the past five years (Figure 5.3c), about 80% of households thought they had experienced "some" or "very big" improvement and only 14% of households thought that there was "no change." The remaining (less than 6%) household heads thought that the well-being of their household actually has experienced "some" or "big" deterioration. On average, these figures on perceived changes in well-being seem to go along with the general positive changes that are observed in terms of per-capita income and wealth between 2006 and 2014 (Table 5.1 and Table 5.2).

Thirdly, the 2014 survey also included two individual level subjective well-being questions. Both the spouse and head of the household were separately asked, by referring to a 10-step ladder, where they personally stand at present if: (1) the top of the ladder represents the 'best possible life' and the bottom step represents the 'worst possible life,' and (2) the top of the ladder represents the 'happiest possible life' and the bottom step represents the 'most miserable life.' On average, household heads thought that they were above the 5th step of the ladder while spouses thought they were above the 6th step of the ladder in terms of 'best possible life.' In terms of 'happiness', household heads and spouses respectively thought that, on average, they were above the 7th and 8th steps of the ladder. In both indicators spouses seem to have higher subjective well-being than the household heads, on average. Cross-tabulation of these two indicators of subjective well-being with aspirations turn in mixed evidence supporting a positive relationship between aspirations and higher subjective well-being among household heads; and, in contrast the relationship seems to be negative among spouses of the household heads (Figure 4). For example, the share of household heads who had higher subjective well-being in terms of both indicators (i.e. "best life" Figure 5.4a, and "happiest life" Figure 5.4c) is larger for those with high aspirations than for those with low aspirations. On the contrary, the share of spouses of the household heads who had higher subjective well-being in terms of both indicators (i.e. "best life" Figure 5.4b, and "happiest life" Figure 5.4d) is larger for those with low aspirations than for those with high aspirations. Perhaps this could be interpreted as follows. Spouses of the household heads in general also revealed lower aspirations by comparison to the household heads, on average. Hence, this could mean that having accepted their situation as it is and without much aspiration for improvement, they are more or less satisfied with what they have. This, as Ray

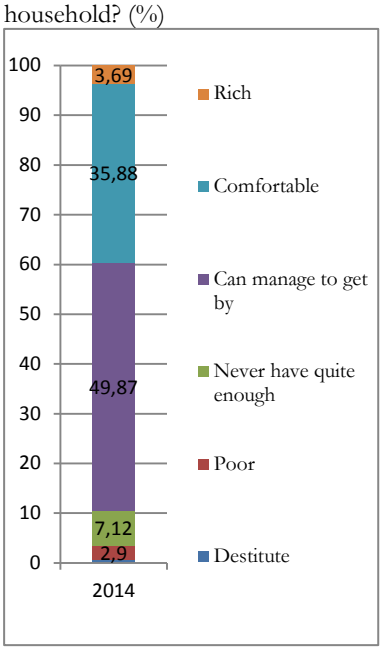
(2006) argues, could be because their dreams are stifled due to poverty and also due to their limited aspirations window for they have limited exposure to media and living and travelling experience outside their village as shown in chapter two; or, alternatively, this could be a reflection of reconciliation to poverty (Sen, 2003).

Figure 5.3. Subjective well-being and change over time (%)

(a) How does your household's welfare or well-being compare with that of other households in the village? (%)



(b) Just thinking about your own household circumstances, how would you describe your household? (%)



(c) How has the well-being of your household changed in the past 5 years (since 2000 EC)? (%)

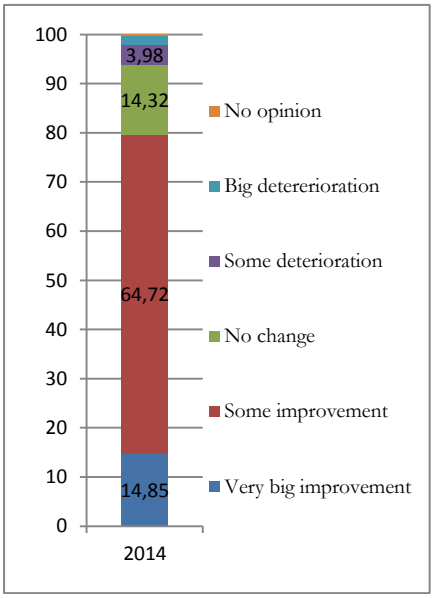
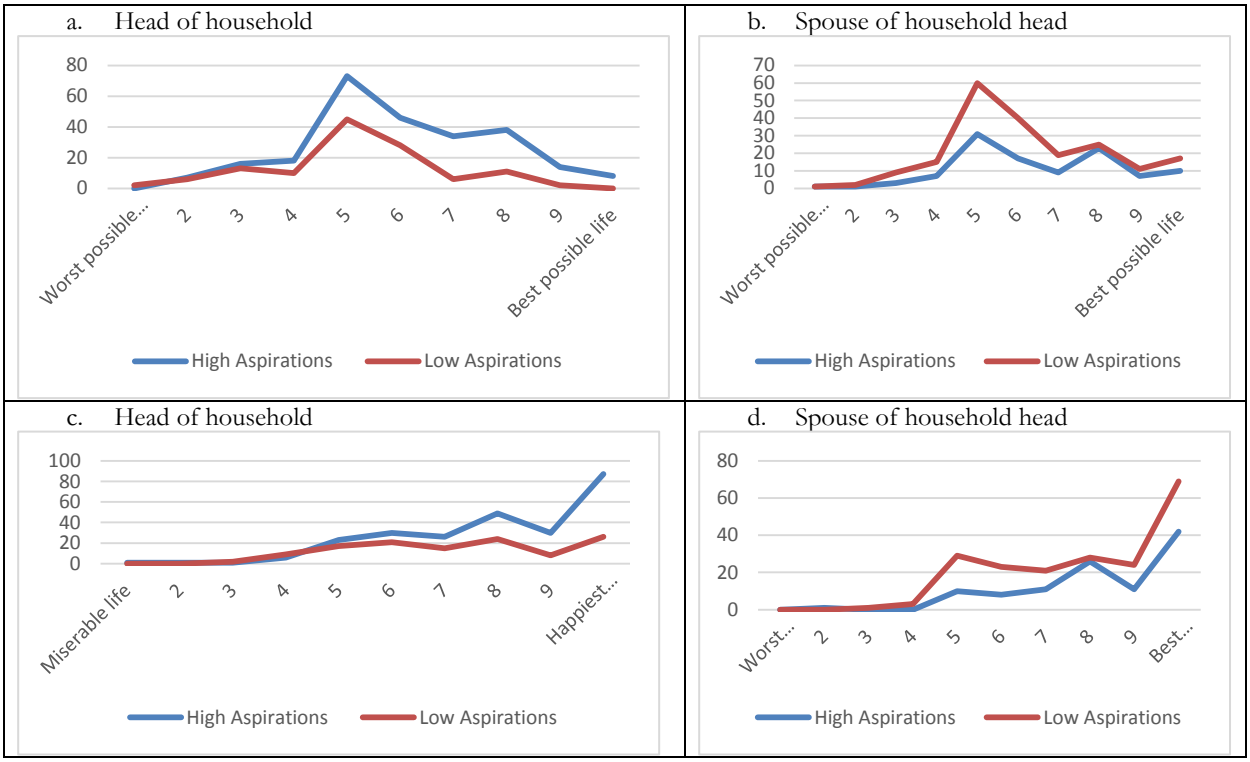


Figure 5.4. Subjective well-being by aspirations status



5.4. Estimation and results

The well-being outcome (y) of the j[th] household[67] can be expressed in the following function:

$$y_j = f(A, I, H, C) \quad (1)$$

Where, A represents the aspirations status (of the household head and of the spouse), I denotes other characteristics of the household head and that of the spouse, H and C respectively denote other household and community level characteristics. As opposed to the assumption behind unitary household models where preferences (or decision making) of the household is often proxied by that of the preferences of the head of the household, in this study we assume joint decision making by the two spouses and hence income, wealth or food security of the household is determined by the characteristics of both the head of the household and of the spouse, in combination with other household and community characteristics including district fixed effects. We estimate a series of an ordinary least squares (OLS) model relating well-being outcomes of the household with the aspirations of the household head and of the spouse and a wide range of other potential determinants. Yet, our purpose remains to see if aspirations of the two spouses, given other factors, are strong correlates of well-being outcomes, without necessarily claiming causal relations. This is because regression results might still be confounded by unobserved household-specific heterogeneity which we could not account for since we only have cross-sectional observations on the main variables of interest (e.g. aspirations and food (in)security indicators).

[67] When the unit of analysis the individual level (e.g. if "y" is subjective well-being), A and I respectively denote the aspirations status and other characteristics of the individual. All other variables remain the same.

Yet, as Angrist and Pischke (2009) argue, "correlation can sometimes provide pretty good evidence of a causal relation" (p.113).

5.4.1. Aspirations and income and consumption expenditure

Based on a review of existing studies, we have discussed the various correlates of income or poverty and food (in)security in rural Ethiopia. None of the existing studies however examine the potential effect of aspirations on well-being outcomes, and this study contributes to filling the gap. Recall that we have shown in a bivariate context that aspirations and well-being outcomes are positively correlated. Beginning with this section, we examine if that relationship holds and whether the correlation is statistically significant after controlling for other potential determinants.

To begin with, Table 5.8 presents a summary of the main results from OLS[68] estimations relating annual per-capita income and monthly consumption expenditure with different determinants using various specifications. Since it is likely that the aspirations of the household head and the spouse are correlated, we control for that effect using the interaction term of the aspirations index of the two spouses (see result columns 1 & 3). Thus, after controlling for other factors, we find that the aspirations index of the household head is positively and significantly associated with the logarithms of per-capita household income (columns 1 & 2) and monthly consumption expenditure (columns 3 & 4).[69] According to these results (columns 1 and 2), holding all other independent variables constant, a standard deviation increase in the aspirations index[70] of the household head is associated with a (0.139 × 0.61) = 0.085 to (0.149 × 0.61) = 0.091 points increase in the logarithm of annual income per-capita. This is about (0.085/7.65) = 1.1 to (0.091/7.65) = 1.2 percent increase over the mean annual income per-capita. Similarly, according to columns 3 and 4, a standard deviation increase in the aspirations index of the household head is associated with a (0.134 × 0.495) = 0.066 to (0.147 × 0.495) = 0.073 points increase in the logarithm of monthly consumption expenditure per-capita. This is about (0.066/6.22) = 1.1 to (0.073/6.22) = 1.2 percent increase over the mean monthly per-capita expenditure. Surprisingly, results (columns 1-3) suggest that, the aspirations of the spouse of the household head do not seem to be statistically significantly correlated with per capita income or expenditure. While column 4 seems to indicate that the aspirations of the spouse of the household head are negatively associated with the per-capita consumption expenditure, the result is not robust for it loses its statistical significance when we control for the interactions term of the aspirations index of the two spouses. Further, in order to check if other results would hold in a unitary household model framework, we drop the aspirations index and other characteristics of the spouse of the household head from subsequent estimations (see columns 5 and 6) and instead control for the gender of the household head. Results suggest that the aspirations index of the household head remain positively and significantly associated with per-capita household income or consumption expenditure. Moreover, it is important to note the robustness of the overall

[68] The data was also fitted to a seemingly unrelated regression model (SUR), but the main results did not change.
[69] The mean and standard deviation of the logarithms of per-capita income and expenditure are (7.65 and 0.896) and 6.22 and 0.495, respectively.
[70] The mean and standard deviation of the aspirations index of the household head are 0.158 and 0.61, respectively.

results even when we control for the change[71] in per capita income or expenditure in the past (i.e. between 2006 and 2010), which is likely to influence both present income and aspirations, and the corresponding interactions term with the aspirations index.

Table 5.8. Correlates of annual income per capita (in log.) and monthly household consumption expenditure per capita (in log.)[72]

	(1) INC_pc1	(2) INC_pc2	(3) EXP_pc1	(4) EXP_pc2	(5) INC_pc3	(6) EXP_pc3
Aspirations Head	0.14***	0.15***	0.13***	0.15***	0.13**	0.13***
	(0.05)	(0.04)	(0.04)	(0.04)	(0.06)	(0.04)
Aspirations Spouse	0.05	0.05	-0.05	-0.07*		
	(0.06)	(0.05)	(0.04)	(0.04)		
Aspirations(Head*Spouse)	0.02		-0.04			
	(0.06)		(0.04)			
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	304	304	304	304	376	376
R2	0.62	0.62	0.41	0.41	0.52	0.37

Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Note: For the full set of results showing all control variables, refer to the Appendix, Table A5. 1.

In addition, consistent with the existing studies, we find that other household characteristics including wealth indicators such as the value of asset holdings, livestock holdings, and size of agricultural land holdings are all strongly positively associated with per capita income or consumption expenditure (Table A5. 1). We also find that education level of the household head is positively and strongly associated with household per capita income or consumption expenditure. In contrast, large family size seems to negatively affect household per-capita income and consumption expenditure. Female household headship is also negatively associated with per-capita income. Among the community characteristics proxied by the average distance to- asphalt road, markets and micro finance institution (MFI), we only find average distance to MFI to be negatively and strongly associated with annual income per capita. However, we fail to find evidence of any statistically significant correlations between household income or expenditure and the incidence of negative shocks such as illness of the household head or spouse, livestock diseases, large increases in input prices, death or loss of livestock, or illness of other family member. This may suggest that the study households are insured against these shocks, which is in line with other studies in rural Ethiopia such as Asfaw and von Braun (2004), Porter (2012) and Yilma et al (2014).

5.4.2. Aspirations and food security

Income and food security may have common determinants, but the two are conceptually distinct. In fact, while income may determine household's economic access to food, it by no means guarantees household food security for the latter requires availability, utilization, and stability of food at all times. In this section, we examine if aspirations are also strong correlates of food security, given other factors that determine each of the four pillars of household food security. Following the existing literature and their availability in the data, we use per-capita

[71] Results remain unchanged when we control for actual level of per capita income or expenditure in 2006 and 2010 instead of the change. Results with actual level of past outcomes are not reported but they are available upon request.

[72] Female headed households drop out from the analysis (column 1-4) when we consider the characteristics of both the household head and the spouse

calorie consumption, FCS, HDDS and HFIAS as measures of food (in)security. Table 5.9 presents a summary of the main correlates of food (in)security. Results suggest that aspirations are indeed strongly associated with household food (in)security. For example, according to column 1, a standard deviation increase in the aspirations index of the household head is associated with a (422.4 × 0.61) = 257.7 calories per-capita per-day increase in household consumption. This is roughly an (257.7/2997) = 8.6 percent increase over the mean calories consumption per-capita per-day. Similarly, according to columns 2 to 4 respectively, a standard deviation increase in the aspirations index of the household head is associated with a (4.5 × 0.61) = 2.75 points increase in FCS, a (0.36 × 0.61) = 0.22 points increase in HDDS, and a (0.34 × 0.61) = 0.21 points decrease in HFIAS (recall that unlike other indicators, HFIAS actually measures food insecurity)[73]. In reference to the corresponding mean outcomes, these are roughly a (2.75/71.4) = 3.9 percent increase in FCS, a (0.22/8.68) = 2.5 percent increase in HDDS, and a (0.21/0.48) = 44 percent decrease in HFIAS. While the magnitude of the coefficient estimates for the aspirations index of the household head slightly decline when we ignore the characteristics of the spouse of the household head (columns 5-8), the correlation remains statistically significant in three out of the four indicators of household food (in)security. This perhaps underlines the importance of controlling for the aspirations and other characteristics of the spouse of the household head even though the coefficient estimates of the spouse's aspirations index are not themselves statistically significant (columns 1-4). Doing so is further supported by not only the theory but also the statistical evidence of the spouse's education as a statistically significant correlate of FCS and HDDS (column 2 and 3).

Table 5.9. Correlation of aspirations and other factors with food (in)security

	(1) pc_Calorie	(2) FCS	(3) HDDS	(4) HFIAS	(5) pc_Calorie_H	(6) FCS_H	(7) HDDS_H	(8) HFIAS_H
Aspirations Head	422.38***	4.50**	0.36**	-0.34**	364.38***	2.82	0.28**	-0.35**
	(129.72)	(1.81)	(0.15)	(0.16)	(123.54)	(1.98)	(0.13)	(0.16)
Aspirations Spouse	-183.02	-0.88	-0.07	-0.00				
	(122.89)	(1.76)	(0.13)	(0.29)				
Aspirations(Head × Spouse)	-82.35	-4.96***	-0.12	0.18				
	(92.69)	(1.52)	(0.13)	(0.19)				
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	302	302	302	302	374	374	374	375
R2	0.35	0.31	0.31	0.23	0.32	0.29	0.30	0.16

Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01
Note: For the full set of results showing all control variables, refer to the Appendix, Table A5. 2.

The strong correlations between aspirations and food security indicators should be put into context, as explained next. Aspirations may affect food security through different channels. First, aspirations may improve households' forward-looking behavior and motivate them to reduce risk by diversifying their livelihood strategies (e.g. by engaging in non-farm income generating activities) which may lead to improved food security (e.g. through improved purchasing power or economic access). Secondly, aspirations may motivate households to reduce their risk aversion and encourage them to invest in agricultural innovations, which are major determinants of

[73] Female headed households drop out from the analysis (column 1-4) when we consider the characteristics of both the household head and the spouse. Thus, the corresponding mean values (for columns 1-4) of per-capita calorie consumption, FCS, HDDS, and HFIAS are respectively 2997, 71.4, 8.68, and 0.48. The corresponding mean values for the full sample regardless of household headship are 3040, 70.5, 8.6, and 0.49.

agricultural productivity which in turn may determine some aspects of food security (such as food availability and stability). Thirdly, farming in Ethiopia is a labor intensive sector and productivity may depend on the physical fitness of farm labor, which in turn is determined by the health status and consumption of foods that provide the necessary nutrients and adequate calories. In this context, aspirations may motivate households to consume more diversified and dietary foods and to make other investments that would improve health and nutrition status leading to at least one aspect of food security (e.g. utilisation). Despite the wide range of control variables including income growth in the past (i.e. between 2006 and 2010), this study does not establish causal inference. However, the findings provide suggestive evidence that higher aspirations may lead to improved food security.

Moving on to other results (Table A5. 2), we find that resource endowments such as annual household income, assets, livestock holdings and relative wealth status (i.e. belonging to the higher wealth quintiles) are positively correlated with some of the food security indicators (columns 1-8). Besides having education level higher than 8th grade, engagement of the spouse of the household head in non-farm income generating activities tends to improve the household's dietary diversity (column 3). Further, negative shocks such as illness of the household head or the spouse and large increases in input prices are negatively associated with food security (column 3 and 4). Remoteness of the household from the market and asphalt road is also negatively associated with food security (columns 2, 3, 6 & 7), which is consistent with the findings of other studies such as Abay and Hirvonen (2016) who report that proximity to food markets improves consumption of more diverse diets and better child nutrition outcomes in northern Ethiopia. Surprisingly, however, results suggest that remoteness of the household from MFI and health center, and the incidence of illness of a household member other than the head and spouse are positively correlated with some of the indicators of food security (columns 2, 6 & 8). Lastly, results also suggest that female headed households are more likely to be food insecure (columns 6 & 7).

5.4.3. Aspirations and subjective well-being

Unlike the objective measures of well-being outcomes such as income or food security, subjective measures such as satisfaction in life may not be necessarily dependent upon own outcomes. Just like aspirations, they are partly driven by one's relative economic position in a society and understanding their correlates may provide strong policy implications, e.g. with respect to economic inequality. For example, as we have seen in the descriptive statistics of this study (see Table 5.1 and Table 5.2), the annual income per-capita and the wealth status of study households have, on average, increased between 2006 and 2014. However, in terms of subjective well-being, the share of people who thought they were "worse than others" has nearly doubled from 13.7 percent in 2006 to 24.8 percent in 2014 while the share of those who thought they were "not different from others" has declined from 72 percent to 53 percent during the same period (Figure 5.3a). At first sight, this may seem like income inequality has also increased over the years despite the observed average income growth among the sample households. If that was the case, it might be natural to expect such inequality would trigger changes in subjective well-being. However, changes in subjective well-being may not necessarily happen in isolation from the individual's beliefs, aspirations and future expectations. Thus, in this section, we examine if there is any strong correlations between aspirations and future expectations and subjective well-being. Subjective well-being in this

case is measured in terms of having 'best life' and 'happy life' by referring to a 10-step ladder where top of the ladder represents 'best/happy life' and bottom of the ladder represents 'worst/miserable life.' In the regressions, we also control for a wide range of other factors that might potentially determine well-being outcomes. To control for the relative economic position of the household in the community, we include indicators of the wealth quintile group and the income quintile group to which the individual's household belongs, in addition to the household's actual income and wealth. Regression results associated with the spouse and the household head are separately summarised in Table 5.10 and Table 5.11, respectively.

According to Table 5.10, neither aspirations nor expectations of the spouse of the household head seem to be strongly associated with either measures of subjective well-being. For household heads, in contrast, Table 5.11 shows that there is a positive and strong correlation between higher aspirations and higher subjective well-being (columns 1 - 4) and between higher expectations and higher subjective well-being (columns 5-8)[74]. Further, the coefficient estimate of the aspirations and expectations indicators remain statistically significant even after controlling for other internal (psychological) factors[75] including the individual's locus of control, self-esteem, perception on the causes of poverty, openness to change, envy, trust in others, exposure to media and information and travel experience outside the village (columns 2, 4, 6 & 8) (Table A5. 4). Yet, contrary to our findings, Knight and Gunatilaka (2012) in rural China and Stutzer (2004) in Switzerland find some evidence of "hedonic treadmill"- that happiness is positively associated with income but negatively associated with aspirations to income for people adapt their aspirations in response to changes in income. Our interpretation of the findings in this study, however, is that the average per-capita income or wealth among sample households has increased between 2006 and 2014. This may mean that these positive changes may have given rise to increased hopes, aspirations and expectations. Since aspirations and expectations are also formed based on what is perceived to be achievable, and in this case the recent experience indicates continuous average growth in income and wealth between 2006 and 2014, they are likely to positively affect happiness or satisfaction in life. Further, despite some improvements in the magnitude of the coefficient estimates, the corresponding results remain qualitatively the same when we drop, from the regressions, the two indicators of the household's relative wealth and income position in the society (results not shown). Perhaps, this may further indicate that aspirations and expectations can be independent sources of higher subjective well-being among household heads.

[74] Note: about 90 percent of household heads are males and the remaining are females who are either widow or divorcee

[75] While internal factors are likely to be correlated to each other, each of the correlation coefficients amongst the indicators used in this study is far less than 0.6, suggesting that multicollinearity is not a problem. Correlation coefficients are reported in the appendix in Table A5. 5

Table 5.10. Correlation of aspirations and other factors with wives' life satisfaction and/or happiness

	(1) BestA1	(2) BestA2	(3) HappyA1	(4) HappyA2	(5) BestE1	(6) BestE2	(7) HappyE1	(8) HappyE2
Aspirations Spouse	-0.32*	-0.16	0.16	0.16				
	(0.19)	(0.21)	(0.23)	(0.22)				
Expectations Spouse					-0.15	0.03	0.16	0.17
					(0.22)	(0.22)	(0.24)	(0.21)
Internal factors	No	Yes	No	Yes	No	Yes	No	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	302	302	302	302	302	302	302	302
R2	0.23	0.28	0.16	0.25	0.23	0.28	0.16	0.25

Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Note: For the full set of results showing all control variables, refer to the Appendix, Table A5. 3.

Table 5.11. Correlation of aspirations and other factors with life satisfaction and/or happiness of the household head

	(1) BestA1	(2) BestA2	(3) HappyA1	(4) HappyA2	(5) BestE1	(6) BestE2	(7) HappyE1	(8) HappyE2
Aspirations Head	0.24*	0.29**	0.42***	0.41***				
	(0.13)	(0.13)	(0.14)	(0.14)				
Expectations Head					0.27	0.37**	0.27	0.34**
					(0.17)	(0.17)	(0.16)	(0.16)
Internal factors	No	Yes	No	Yes	No	Yes	No	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	374	374	373	373	374	374	373	373
R2	0.30	0.34	0.21	0.24	0.30	0.34	0.20	0.24

Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Note: For the full set of results showing all control variables, refer to the Appendix, Table A5. 4.

The relationship between life satisfaction and current income, and life satisfaction and relative income is inconclusive in the literature. For example, Easterlin (1995) concludes that "…within a country at a given time, those at higher incomes are, on average, happier. However, raising the incomes of all does not increase the happiness of all. This is because the material norms on which judgments of well-being are based increase in the same proportion as the actual income of the society" (p.44). Accordingly, as can be seen in Table A5. 4, we find that the relative per-capita income and the relative wealth status of the household (both measured in terms of quintile group that the household belongs to) are positively and strongly associated with subjective well-being of the household head, and this is true in all specifications (columns 1 – 8). However, we fail to find a statistically strong correlations between actual per-capita income and the two measures of subjective well-being, and between actual household wealth and subjective well-being measured in terms of happiness (Table A5. 3 and Table A5. 4). If any, Table A5. 4, column 8 suggests that happiness and actual income per capita are negatively and statistically significantly associated. Our findings are in line with Easterlin's (1995) conclusion. On the other hand, based on a review of existing studies, Helliwell et al (2012) argue that absolute income is important for subjective well-being in poor countries while comparative income is rather the most important in richer countries. This contradicts not only our findings, but also partly others' such as Alem's (2014) who, based on panel data from urban Ethiopia, also finds that happiness increases with relative income. But contrary to our findings, Alem (2014) in urban Ethiopia and Kinght and Gunatilaka (2012) in rural China find that happiness increases with actual income.

Among other characteristics, we find that family size of the household is positively and strongly associated with subjective well-being of the household head (Table A5. 4, columns 1 and 5). This perhaps could be associated with the support the household could enjoy from the potential labor pool, particularly as the household head ages. In line with this, Conzo et al (2015) also find a strong relationship between subjective well-being of the household head and family size in rural Ethiopia. Having some level of education and having experienced large increases in input prices are negatively and statistically significantly associated with subjective well-being of the household head and this is true for all specifications (Table A5. 4). On the other hand, when we consider wives, the incidence of negative shocks such as large increase in input prices, illness of the household head or the spouse, and death or loss of livestock, and remoteness of the market are negatively and statistically significantly associated with subjective well-being (Table A5. 3). In addition, we also find that own participation in off-farm income generating activities is negatively and strongly associated with subjective well-being of the spouse of the household head. This could be because wives engage in such activities not necessarily out of preference but rather out of the household's needs for additional income. Putting this into context, traditionally wives in rural Ethiopia are mainly responsible for in-house chores and other household production that may include working on own farm. Hence, any deviation from this kind of 'culture' or the burden of having additional responsibilities may negatively affect their subjective well-being or satisfaction in life.

5.5. Conclusions

This Chapter empirically examines if aspirations are important correlates of well-being outcomes in rural Ethiopia. We establish robust evidence by employing several objective as well as subjective measures of well-being outcomes including income and expenditure, multi-dimensional food security indicators, and satisfaction in life or subjective well-being. Descriptive statistics suggest that individuals with high aspirations have on average higher income or wealth by comparison to those with low aspirations and the difference is statistically significant. Similarly, across different food security categories, the share of people with low-aspirations increases as we move from the most food secure to the extremely food insecure categories, and this is true for most of the indicators. Cross-tabulation of subjective well-being (using indicators of life satisfaction and/or happiness) with aspirations however turns in mixed evidence that the relationship is positive among household heads while in contrast the relationship is negative among their spouses.

We use regressions to relate each well-being outcome against the aspirations indicator and other potential drivers including human capital, the household's access to: natural capital, physical capital, financial capital, roads, markets and other services. To account for the unobserved factors common to all residents in each study site, we control for district fixed effects. The main finding of the study, which is robust across outcome indicators and specifications, is that the aspirations of the household head are important predictors of household well-being in rural Ethiopia. On the other hand, while we fail to find a statistically significant effect of the aspirations of the spouse, their inclusion in the regressions along with other characteristics of the spouse, increases the magnitude of the coefficient estimates for the aspirations of the household head. This perhaps indirectly underscores the

importance of the spouse's contribution to the household decision making and the corresponding well-being outcomes. Regarding outcome indicators measured at individual level such as satisfaction in life or happiness, we also find positive and strong effect of aspirations and future expectations of the household head. In contrast, for the spouse of the household head, aspirations and expectations do not seem to be strongly correlated with subjective well-being.

Despite the cross-sectional nature of the data used in this study, which is the major limitation for unobserved household characteristics might still affect both the aspirations and the well-being outcomes or the possibility of reverse causation, the robustness of findings across various indicators suggest that aspirations are indeed strong determinants of well-being outcomes in rural Ethiopia. Yet, it is important to note that we have controlled for the district fixed effects, the present as well as past income and wealth levels or their changes, other psychological factors and a wide range of other factors which might affect both the aspirations and the present level outcome indicators. This perhaps would help minimize the influence of the error term that would result from unobserved heterogeneity. Further, we had also established in the preceding chapters that aspirations are also strongly correlated with the adoption of agricultural innovations and risk taking behavior which are all underlying determinants of household income or wealth and food security. Therefore, based on these findings, we conclude that targeting the determinants of aspirations may be a useful policy strategy to improving well-being outcomes in rural Ethiopia.

6. SUMMARY AND CONCLUSIONS

The persistence of poverty in some parts of the society across the globe inspired recent studies in development economics to embrace the use of multidisciplinary tools and concepts to better understand the situation of the poor. This thesis employs one of the recent conceptual tools, the aspirations-failure framework, which links the situation of the poor and their (under)investment behavior to low aspirations (or aspirations failure). The thesis uses individual and household level data collected in rural Ethiopia to understand how aspirations are formed and how they are correlated with various outcomes. Aspirations were elicited in reference to income, wealth, education and social status. Based on the standardized indices of the four indicators as well as their aggregate index Chapter 2 examines the social drivers of aspirations. Analysis of the data suggest that, besides own outcomes such as income or wealth and other characteristics of the household, the average achievements of "relevant others" drives aspirations, confirming the theory that aspirations are socially determined. Results by gender suggest that the effect of social interactions on aspirations is statistically strong only for females. The evidence further shows that the effect of social interactions on aspirations is particularly larger and statistically stronger when the reference group is wider and the people that comprise the reference group are richer than the individual or richer than the village average. This may also be referred to as motivations externality.

One of the channels in which aspirations may affect behavior is indirectly through their effect on risk aversion. Chapter 2 also examines the effect of aspirations on risk preferences. Risk preferences were elicited using lottery choices where the outcomes were determined by coin toss. According to the theory, aspirations (or aspirations-gap (AG)) affect forward looking behavior (which may include minimized risk aversion) non-linearly. Chapter 2 econometrically confirms that is actually the case. For example, results suggest that a standard deviation increase in the AG level is associated with a 0.21 standard deviations reduction in risk aversion. The negative and statistically significant coefficient of the square term of the AG index confirms the hypothesized non-linear effect of the AG on risk behavior. Based on alternative specifications, results suggest that individuals with narrow AG are associated with risk aversion that is 0.22 to 0.41 standard deviations higher than those with moderate AG. The corresponding risk aversion of those with large AG is 0.26 to 0.31 standard deviations higher than those with moderate AG. Results also indicate that the effect of AG on risk preferences is stronger for women. Chapter 2 further tests robustness of these findings using matching estimators and the overall results confirm that moderate AG indeed enhances risk-taking (or relaxes risk aversion), implying that an aspirations level which is "large enough to incentive but not so large to induce frustrations" (Genicot and Ray, 2014) may help minimize risk aversion.

Social interactions may not only result in aspirations, but may also generate knowledge externalities. Accordingly, Chapter 3 examines the existence of social learning in smallholder agriculture in Ethiopia. To overcome identification challenges that may arise from endogenous network formation, simultaneity or reflection bias, the study relies on a specially designed and collected social networks data where social networks were exogenously

assigned using a 'random matching within sample' procedure. The study also benefits from the semi-panel nature of the data and the exogenous intervention in the past that reached only some of the households in the sample. Using econometric strategies that help isolate social learning from that of correlated and contextual effects, the study finds strong evidence of network externalities in the adoption of row-planting and also in farm productivity.

Despite such evidence of social learning, some people tend to be more innovative than others, given the same resource constraints. One of the major explanations that comes out of the social psychology and related literature is that beliefs or the sense of control individuals have over their life shape their preferences, such as their aspirations. Hence the difference in aspirations among people may explain the observed differences in their behavior, for instance the adoption or non-adoption of agricultural innovations. This needs empirical test, however. Further, aspirations are assumed to influence such behavior directly through motivations and indirectly through their effect on risk attitude which is a widely established determinant of innovations. Chapter 4 examines the direct motivation effects of aspirations (or AG) on the adoption of agricultural innovations such as improved seed, fertilizers, chemicals, and row-planting. The study conducts plot level and household level analysis. Results suggest that having narrow or very large aspirations-gap is strongly associated with low level of innovativeness and low adoption of inorganic fertilizers. According to the econometric estimates, for example, a household with narrow or very-large AG is associated with lower use of fertilizers by about 105kg/ha, on average, than an otherwise similar household with moderate level of AG. These findings are in line with the theory which suggests that moderate aspirations motivate future-oriented behavior. The findings are also in line with other empirical studies such as Bernard et al. (2014) and Ghosal et al. (2013) which find strong impacts of aspirations on savings, increased demand for credit and other forward-looking behaviors. The findings of Chapter 4 have strong policy implications for the adoption of innovations is widely recognized as a key for sustainable development and improved rural livelihoods as in the context of this thesis.

The main goal of the thesis is ultimately to try to understand the well-being implications of aspirations by examining their interactions with the underlying factors (such as the adoption of agricultural innovations) as well as their interactions with the well-being outcomes themselves. To examine the latter, Chapter 5 uses various outcome indicators including income and consumption expenditure, various triangulating measures of food security, and subjective well-being defined in terms of life satisfaction and happiness. In nearly all outcome indicators, the study finds suggestive evidence that aspirations particularly that of the household head, are important predictors of household well-being in rural Ethiopia. Some of the econometric estimates, for example, suggest that a standard deviation increase in the aspirations index of the household head is associated, on average, with an 8.6 percent increase in daily calories consumption per-capita, a 3.9 percent increase in food consumption score (FCS), a 2.5 percent increase in household dietary diversity score (HDDS), a 44 percent reduction in household food insecurity access scale (HFIAS), and about 1.2 percent increase over the mean income or consumption expenditure per-capita of the household.

This thesis is not without limitations, however, and the three major ones deserve mentioning. The first one is associated with measurement error. While individuals aspire to achieve different things in life, some of which are quantifiable while others not, and more important to some than to others, the four indicators used to measure aspirations may not capture the whole concept of aspirations. But, it is believed that these four indicators are correlated with a broad array of life targets and hence could serve as a strong proxy to measuring aspirations. Second, with the intention of having lagged observations which are crucial for identification, the survey which this thesis mainly relies upon covered an existing sample of farm households who had been interviewed by other organization in the past. Since the original survey used a mix of purposive and random sampling procedures from study sites which have high agricultural potential, the external validity of the study might be limited. Most of the findings of the thesis, however, are in line with the theory and a few other empirical studies that used larger samples. Third, while this thesis benefits from the availability and use of lagged observations of other explanatory variables, which are key to partially tackle issues related to reverse causation and other identification challenges, the main variable of interest (i.e. aspirations) is observed only once (i.e. in the latest survey). Yet, since aspirations evolve over time in light of new experiences, choices and information, the thesis could not capture such dynamics and hence the corresponding interactions effect of aspirations with other outcomes. Some of the results in this thesis may suffer from such limitations and hence the coefficient estimates may tend to be under- or overstated. Yet, it is worth noting that, to the best of the author's knowledge, this is the first empirical test of the aspirations failure framework in terms of adoption of agricultural innovations and the various dimensions of food security.

Given those caveats, the overall findings of the thesis clearly demonstrate that beyond the resource-related deprivations, psychological constraints such as low aspirations also play a role in rural households' decision-making in Ethiopia, with consequences on well-being outcomes. Targeting the determinants of aspirations may therefore be a useful policy strategy in the context of farm households in Ethiopia. This is because moderately raised aspirations may also help improve the effectiveness of other policies aimed at improving the adoption of agricultural innovations and well-being outcomes. The implementation of such strategy may rely on social networks, for social interactions may not only help amplify motivation effects or help broaden the 'aspirations window' of the poor and particularly that of women, they may also help generate knowledge spill overs such as the adoption of agricultural innovations. The policy relevance of findings in this thesis could be emphasised in the words of Bandura (2009), who states that "failure to address the psychosocial determinants of human behavior is often the weakest link in social policy initiatives. Simply providing ready access to resources does not mean that people will take advantage of them" (p. 505). Further, the key messages of this thesis can be seen as support for the recent call of the World Bank for a new set of development approaches, "viewing people more fully and recognizing that a combination of psychological and social forces affects their perception, cognition, decisions, and behaviors", as formulated in the world development report of 2015.

As the saying goes, "a picture is worth a thousand words:"

Source: Unknown, downloaded from Facebook.

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APPENDICES

Table A2. 1. The effect of social interactions on each dimension of aspirations: RG - All
(Using average outcome of all in the reference group)#

	(1) Inc1	(2) Inc2	(3) Assets1	(4) Assets2	(5) Status1	(6) Status2	(7) Educ1	(8) Educ2
Peers' Ave. income(ln)	0.00	-0.02						
	(0.07)	(0.04)						
Peers' Ave. V.assets (ln)			-0.01	-0.05				
			(0.06)	(0.04)				
Peers' Ave. S.status (ln)					0.15	0.10		
					(0.11)	(0.08)		
Peers' Ave. ch.education							0.02	0.00
							(0.05)	(0.04)
Network size	0.09***	0.03*	0.03	0.01	0.02***	0.01**	0.10*	0.12**
	(0.02)	(0.01)	(0.03)	(0.02)	(0.01)	(0.01)	(0.06)	(0.06)
Male+	0.42***	0.16**	0.56***	0.32***	0.05**	0.01	0.48***	0.54**
	(0.08)	(0.08)	(0.08)	(0.07)	(0.03)	(0.02)	(0.18)	(0.23)
Age in years	0.02	0.01	-0.01	-0.01	-0.00	0.00	0.34***	0.06
	(0.01)	(0.01)	(0.02)	(0.02)	(0.00)	(0.00)	(0.11)	(0.08)
Square of age	-0.00	-0.00	0.00	0.00	0.00	-0.00	-0.00***	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education level	0.04**	0.00	0.06***	0.01	0.01**	0.00	0.02	-0.00
	(0.01)	(0.01)	(0.02)	(0.01)	(0.00)	(0.00)	(0.04)	(0.04)
Land in ha_2006 (ln)	0.21**	0.01	0.18***	0.06	0.02*	-0.00	0.61*	0.27
	(0.10)	(0.05)	(0.06)	(0.06)	(0.01)	(0.01)	(0.33)	(0.22)
Value of assets_2006 (ln)	0.20***	0.02	0.24***	0.04	0.00	0.00	0.01	-0.20
	(0.04)	(0.03)	(0.05)	(0.03)	(0.01)	(0.01)	(0.13)	(0.13)
Dist. coop office (minutes)(ln)	-0.00	0.01	-0.11	0.00	0.03***	0.01	-0.31	-0.07
	(0.05)	(0.05)	(0.07)	(0.05)	(0.01)	(0.01)	(0.20)	(0.18)
Dist. asphalt road (minutes)(ln)	0.06	0.02	-0.09**	-0.02	-0.01	-0.01	0.09	0.04
	(0.05)	(0.03)	(0.04)	(0.04)	(0.01)	(0.01)	(0.17)	(0.14)
Increased input prices+	0.02	-0.14*	0.08	0.09	-0.06**	0.01	0.46	0.02
	(0.15)	(0.08)	(0.14)	(0.15)	(0.03)	(0.04)	(0.43)	(0.30)
Death/ loss of livestock+	-0.15	-0.05	-0.43**	-0.08	0.05	0.04	0.50	0.36
	(0.13)	(0.07)	(0.19)	(0.10)	(0.03)	(0.03)	(0.50)	(0.51)
Illness of head/spouse+	-0.00	0.10	-0.07	0.19	-0.05	-0.04***	-0.46	-0.35
	(0.09)	(0.08)	(0.16)	(0.12)	(0.03)	(0.01)	(0.72)	(0.69)
Illness of other family+	-0.24**	-0.08	-0.30*	-0.09	0.00	-0.06	-0.26	0.45
	(0.10)	(0.08)	(0.17)	(0.09)	(0.03)	(0.04)	(0.36)	(0.48)
Self-esteem		0.02		0.20***		-0.03		0.03
		(0.09)		(0.05)		(0.03)		(0.34)
Subj. welbeing		-0.03		-0.06**		0.01		0.07
		(0.04)		(0.02)		(0.02)		(0.12)
Discount factor		0.02		-0.00		-0.01		0.17***
		(0.02)		(0.02)		(0.01)		(0.06)
Present income(ln) (perceived)		0.89***						
		(0.04)						
Present v.assets(ln) (perceived)				0.72***				
				(0.05)				
Present s.status(ln) (perceived)						0.35***		
						(0.09)		
Present ch.education								0.34***
								(0.08)
Hettosa-Tiyyo+	0.28*	-0.26**	-0.04	-0.11	-0.03	-0.02	-0.87***	-1.08***
	(0.15)	(0.10)	(0.13)	(0.09)	(0.03)	(0.02)	(0.33)	(0.26)
Adaa-Lume+	0.21**	-0.13	0.09	0.01	-0.07*	-0.05**	-1.75***	-1.83***
	(0.09)	(0.09)	(0.14)	(0.13)	(0.04)	(0.02)	(0.29)	(0.24)
Constant	7.87***	1.59**	10.05***	4.08***	3.77***	2.60***	4.73*	10.71***
	(0.84)	(0.69)	(1.20)	(1.20)	(0.41)	(0.62)	(2.66)	(2.04)
Observations	635	633	635	633	635	633	635	633
R-squared	0.213	0.579	0.263	0.586	0.092	0.393	0.13	0.262

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01. #Note: the following indicators were controlled but the coefficients were not statistically significant: distance to- market, FTC, nearest input dealer; dummies for experience of shocks including too much rain/flood, and livestock diseases; and internal traits such as locus of control, trust in others, and two indicators of risk preferences. +Binary

Table A2. 2. The effect of social interactions on each dimension of aspirations: RG - richer
(Using average outcome of those who are richer than the respondent)#

	(1) Inc1	(2) Inc2	(3) Assets1	(4) Assets2	(5) Status1	(6) Status2	(7) Educ1	(8) Educ2
Ave. of Peers' above Ave. income(ln)	0.606***	0.082**						
	(0.048)	(0.035)						
Ave. of Peers' above Ave. V.assets (ln)			0.493***	0.000				
			(0.085)	(0.075)				
Ave. of Peers' above Ave. S.status (ln)					0.586***	-0.033		
					(0.154)	(0.112)		
Ave. of Peers' above Ave. ch.education							0.266***	-0.198**
							(0.077)	(0.078)
Network size	0.047	0.008	0.033	0.019	0.018***	0.013*	0.190	0.135
	(0.029)	(0.019)	(0.031)	(0.024)	(0.006)	(0.007)	(0.120)	(0.102)
Male+	0.398***	0.208**	0.578***	0.360***	0.028*	0.013	0.564**	0.665**
	(0.107)	(0.081)	(0.098)	(0.102)	(0.015)	(0.020)	(0.284)	(0.282)
Age in years	0.016	0.015	0.008	-0.002	0.001	-0.002	0.272***	0.005
	(0.011)	(0.011)	(0.022)	(0.016)	(0.004)	(0.003)	(0.103)	(0.079)
Square of age	-0.000*	-0.000	-0.000	-0.000	-0.000	0.000	-0.003***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Education level	0.016	0.001	0.028*	0.001	0.003	0.004	0.031	0.004
	(0.013)	(0.010)	(0.017)	(0.016)	(0.003)	(0.003)	(0.058)	(0.049)
Land in ha_2006 (ln)	0.186**	0.046	0.151**	0.076	0.008	-0.001	0.622	0.327
	(0.076)	(0.055)	(0.060)	(0.075)	(0.015)	(0.015)	(0.385)	(0.293)
Value of assets_2006 (ln)	0.107***	0.012	0.142***	0.043*	0.005	-0.005	-0.088	-0.246
	(0.022)	(0.027)	(0.038)	(0.025)	(0.011)	(0.015)	(0.174)	(0.184)
Dist. coop office (minutes)(ln)	0.064*	0.050	-0.062	-0.008	0.028**	0.009	-0.240	-0.062
	(0.039)	(0.047)	(0.070)	(0.056)	(0.013)	(0.021)	(0.292)	(0.265)
Death/ loss of livestock+	-0.233**	-0.097	-0.334*	-0.123	0.062	0.060*	0.550	0.690
	(0.098)	(0.073)	(0.189)	(0.126)	(0.045)	(0.032)	(0.703)	(0.725)
Illness of other family+	-0.134	-0.015	-0.268*	-0.102	-0.032	-0.047	-0.008	0.582
	(0.126)	(0.106)	(0.153)	(0.113)	(0.045)	(0.044)	(0.340)	(0.475)
Locus of control		0.196**		0.165		0.005		0.791
		(0.086)		(0.105)		(0.028)		(0.480)
Self-esteem		0.045		0.173**		-0.022		0.085
		(0.109)		(0.071)		(0.040)		(0.453)
Discount factor		0.014		0.007		-0.007		0.174**
		(0.021)		(0.022)		(0.007)		(0.084)
Risk_lottery		-0.009		0.053		-0.021*		-0.232*
		(0.019)		(0.034)		(0.011)		(0.127)
Risk_Market		0.026		-0.031		0.026		0.349*
		(0.018)		(0.040)		(0.016)		(0.199)
Present income(ln) (perceived)		0.773***						
		(0.078)						
Present v.assets(ln) (perceived)				0.723***				
				(0.061)				
Present s.status(ln) (perceived)						0.408***		
						(0.122)		
Present ch.education								0.531***
								(0.137)
Hettosa-Tiyyo+	-0.085	-0.264***	-0.059	-0.107	-0.026	-0.023	-1.032***	-1.355***
	(0.058)	(0.086)	(0.140)	(0.121)	(0.035)	(0.023)	(0.384)	(0.344)
Adaa-Lume+	-0.053	-0.157**	0.046	0.006	-0.094**	-0.053**	-2.036***	-2.187***
	(0.071)	(0.075)	(0.130)	(0.144)	(0.046)	(0.024)	(0.280)	(0.189)
Constant	2.346***	1.630**	4.315***	3.443***	1.795***	3.014***	3.969	13.663***
	(0.543)	(0.806)	(1.511)	(1.269)	(0.583)	(0.294)	(3.148)	(3.177)
Observations	510	508	481	481	476	474	456	455
R-squared	0.309	0.496	0.303	0.518	0.177	0.380	0.166	0.297

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01. #Note: the following indicators were controlled but the coefficients were not statistically significant: distance to- market, asphalt road, FTC, nearest input dealer; dummies for experience of shocks including too much rain/flood, increased input prices, illness of household head/spouse, and livestock diseases; and internal traits such as trust in others and subjective well-being. +Binary

Table A2. 3. The effect of social interactions on aspirations: RG - Networks
(Social networks as reference group) #

	(1) Asp. Av.	(2) Asp. Av.	(3) Asp. Av.	(4) Asp. ab. Av.	(5) Asp. ab. Av.	(6) Asp. ab. Av.
Peers' Ave. Asp.index	-0.030	-0.025	-0.047			
	(0.090)	(0.083)	(0.075)			
Av. of Peers' above av.Aspindex				0.436***	0.425***	0.370***
				(0.058)	(0.054)	(0.043)
Network size	0.048***	0.044***	0.027*	0.045***	0.044***	0.039***
	(0.016)	(0.016)	(0.016)	(0.009)	(0.009)	(0.010)
Male+	0.190***	0.151***	0.079	0.087**	0.078**	0.058
	(0.055)	(0.051)	(0.057)	(0.038)	(0.036)	(0.038)
Age in years	0.025*	0.023*	0.009	0.024***	0.025***	0.008
	(0.014)	(0.012)	(0.013)	(0.008)	(0.008)	(0.008)
Square of age	-0.000	-0.000	-0.000	-0.000***	-0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education level	0.036***	0.029***	0.019**	0.015***	0.013***	0.008**
	(0.008)	(0.009)	(0.008)	(0.004)	(0.004)	(0.004)
Land in ha_2006 (ln)	0.099**	0.084*	0.007	0.083***	0.076***	0.031
	(0.045)	(0.043)	(0.041)	(0.021)	(0.021)	(0.019)
Value of assets_2006 (ln)	0.090***	0.068***	0.012	0.026	0.016	-0.010
	(0.029)	(0.025)	(0.030)	(0.018)	(0.017)	(0.019)
Dist. coop office (minutes)(ln)	0.017	0.029	0.037	0.039**	0.044***	0.053***
	(0.027)	(0.028)	(0.030)	(0.016)	(0.016)	(0.019)
Dist. FTC (minutes)(ln)	-0.024	-0.039	-0.059	-0.050***	-0.056***	-0.071***
	(0.037)	(0.037)	(0.039)	(0.016)	(0.016)	(0.017)
Illness of head/spouse+	0.027	0.026	0.078	-0.094**	-0.093**	-0.055
	(0.089)	(0.085)	(0.093)	(0.046)	(0.044)	(0.042)
Illness of other family+	-0.169**	-0.129*	-0.102*	-0.029	-0.030	-0.002
	(0.066)	(0.078)	(0.061)	(0.055)	(0.063)	(0.062)
ILC index		0.167**	0.106*		0.094**	0.080**
		(0.067)	(0.064)		(0.041)	(0.040)
Trust index		0.039***	0.037***		0.010	0.014
		(0.013)	(0.014)		(0.020)	(0.015)
Subj. welbeing		0.077***	0.015		0.044***	-0.000
		(0.023)	(0.023)		(0.015)	(0.018)
Risk_lottery		-0.011	-0.021		-0.012	-0.015
		(0.017)	(0.016)		(0.008)	(0.010)
Risk_Market		0.016	0.026		0.013*	0.017*
		(0.021)	(0.021)		(0.008)	(0.009)
Present income(ln) (perceived)			0.230***			0.073***
			(0.020)			(0.026)
Present v.assets(ln) (perceived)			0.050*			0.034
			(0.027)			(0.022)
Present s.status(ln) (perceived)			0.181***			0.142***
			(0.037)			(0.054)
Present ch.education			0.018**			0.024***
			(0.007)			(0.007)
Hettosa-Tiyyo+	-0.165**	-0.190***	-0.322***	-0.060	-0.070	-0.120**
	(0.078)	(0.073)	(0.062)	(0.067)	(0.065)	(0.053)
Adaa-Lume+	-0.103*	-0.133***	-0.198***	-0.018	-0.028	-0.049
	(0.054)	(0.051)	(0.056)	(0.061)	(0.061)	(0.043)
Constant	-2.050***	-1.819***	-4.528***	-1.470***	-1.415***	-2.544***
	(0.310)	(0.317)	(0.567)	(0.252)	(0.275)	(0.343)
Observations	635	633	633	519	518	518
R-squared	0.196	0.238	0.328	0.418	0.431	0.492

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01. #Note: the following indicators were controlled but the coefficients were not statistically significant: distance to- market, asphalt road, nearest input dealer; dummies for experience of shocks including too much rain/flood, increased input prices, livestock diseases, and death/ loss of livestock; and internal traits such as self-esteem and discount factor (or time preference). +Binary

Table A2. 4. The effect of social interactions on each dimension of aspirations: RG – village, all
(Using average outcome of all in the reference group) #

	(1) Inc1	(2) Inc2	(3) Assets1	(4) Assets2	(5) Status1	(6) Status2	(7) Educ1	(8) Educ2
Vill. ave. income(ln)	0.000***	0.000**						
	(0.00)	(0.00)						
Vill. ave. v.assets(ln)			0.000**	0.000*				
			(0.00)	(0.00)				
Vill. ave. s.status(ln)					0.010***	0.007***		
					(0.00)	(0.00)		
Vill. ave. ch.education							0.131	0.130
							(0.15)	(0.16)
Male+	0.482***	0.179**	0.598***	0.345***	0.063**	0.014	0.496***	0.510**
	(0.10)	(0.08)	(0.08)	(0.08)	(0.03)	(0.02)	(0.18)	(0.21)
Age in years	0.022	0.015	-0.000	-0.007	0.002	0.000	0.303***	0.045
	(0.02)	(0.01)	(0.02)	(0.02)	(0.00)	(0.00)	(0.10)	(0.07)
Square of age	-0.000	-0.000	-0.000	0.000	0.000	-0.000	-0.003***	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education level	0.040***	0.005	0.065***	0.014	0.007**	0.001	0.027	-0.006
	(0.01)	(0.01)	(0.02)	(0.01)	(0.00)	(0.00)	(0.04)	(0.04)
Land in ha_2006 (ln)	0.225**	0.022	0.205***	0.071	-0.006	-0.020	0.574**	0.221
	(0.10)	(0.05)	(0.05)	(0.05)	(0.01)	(0.01)	(0.29)	(0.21)
Value of assets_2006 (ln)	0.201***	0.016	0.248***	0.045**	0.020	0.013	0.046	-0.157
	(0.04)	(0.03)	(0.06)	(0.02)	(0.02)	(0.01)	(0.13)	(0.14)
Dist. coop office (minutes)(ln)	-0.033	0.003	-0.113*	0.008	0.027***	0.013	-0.259	-0.030
	(0.05)	(0.05)	(0.07)	(0.05)	(0.01)	(0.01)	(0.19)	(0.18)
Dist. asphalt road (minutes)(ln)	0.046	0.025	-0.098**	-0.012	-0.006	-0.004	0.134	0.100
	(0.04)	(0.03)	(0.05)	(0.04)	(0.01)	(0.01)	(0.18)	(0.16)
Increased input prices+	0.038	-0.130*	0.040	0.074	-0.060**	0.001	0.553	0.094
	(0.14)	(0.07)	(0.16)	(0.15)	(0.03)	(0.03)	(0.46)	(0.33)
Death/ loss of livestock+	-0.166	-0.054	-0.431***	-0.102	0.050	0.033	0.553	0.397
	(0.12)	(0.07)	(0.17)	(0.09)	(0.03)	(0.03)	(0.49)	(0.49)
Illness of head/spouse+	-0.023	0.089	-0.041	0.201*	-0.058**	-0.055***	-0.469	-0.336
	(0.09)	(0.09)	(0.16)	(0.12)	(0.03)	(0.02)	(0.71)	(0.69)
Illness of other family+	-0.234***	-0.076	-0.260*	-0.069	-0.002	-0.053	-0.239	0.435
	(0.08)	(0.07)	(0.15)	(0.08)	(0.03)	(0.04)	(0.35)	(0.45)
Locus of control		0.122*		0.099		0.014		0.707*
		(0.06)		(0.09)		(0.03)		(0.39)
Self-esteem		0.017		0.213***		-0.016		-0.024
		(0.09)		(0.05)		(0.03)		(0.34)
Subj. welbeing		-0.041		-0.065***		0.009		0.061
		(0.04)		(0.02)		(0.01)		(0.13)
Risk_lottery		0.008		0.028		-0.016*		-0.167
		(0.02)		(0.02)		(0.01)		(0.12)
Risk_Market		-0.005		-0.018		0.019		0.254*
		(0.01)		(0.03)		(0.01)		(0.15)
Present income(ln) (perceived)		0.890***						
		(0.04)						
Present v.assets(ln) (perceived)				0.724***				
				(0.05)				
Present s.status(ln) (perceived)						0.355***		
						(0.08)		
Present ch.education								0.329***
								(0.07)
Hettosa-Tiyyo+	-0.020	-0.383***	-0.055	-0.141*	-0.043*	-0.031	-1.015**	-1.297***
	(0.10)	(0.09)	(0.12)	(0.08)	(0.02)	(0.02)	(0.44)	(0.36)
Adaa-Lume+	0.056	-0.191**	0.078	-0.007	-0.064**	-0.056***	-1.868***	-2.061***
	(0.10)	(0.09)	(0.11)	(0.10)	(0.03)	(0.02)	(0.33)	(0.32)
Constant	7.879***	1.285*	9.403***	3.179***	3.694***	2.542***	4.980*	10.399***
	(0.51)	(0.66)	(0.88)	(0.84)	(0.21)	(0.36)	(2.73)	(2.32)
Observations	665	663	665	663	665	663	665	663
R-squared	0.222	0.592	0.285	0.604	0.081	0.390	0.121	0.248

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01. #Note: the following indicators were controlled but the coefficients were not statistically significant: distance to- market, nearest input dealer, FTC; dummies for experience of shocks including too much rain/flood, livestock diseases; and internal traits such as trust in others, and discount factor. +Binary

Table A2. 5. The effect of social interactions on each dimension of aspirations: RG – village, richer
(Using average outcome of those who are richer than the village average) #

	(1) Inc1	(2) Inc2	(3) Assets1	(4) Assets2	(5) Status1	(6) Status2	(7) Educ1	(8) Educ2
Mean outcome above village average								
Income(ln)	0.566***	0.204**						
	(0.09)	(0.08)						
Value of assets(ln)			0.338***	0.145*				
			(0.09)	(0.08)				
Social status(ln)					0.502**	0.075		
					(0.25)	(0.20)		
Children's .education							-2.991	-5.946
							(4.07)	(4.92)
Male+	0.481***	0.182**	0.604***	0.348***	0.059**	0.013	0.499***	0.541**
	(0.10)	(0.08)	(0.08)	(0.08)	(0.03)	(0.02)	(0.18)	(0.21)
Age in years	0.021	0.015	-0.001	-0.007	0.001	0.000	0.300***	0.034
	(0.02)	(0.01)	(0.02)	(0.02)	(0.00)	(0.00)	(0.10)	(0.06)
Square of age	-0.000	-0.000	-0.000	0.000	0.000	-0.000	-0.003***	-0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education level	0.040***	0.005	0.064***	0.014	0.007***	0.002	0.025	-0.007
	(0.01)	(0.01)	(0.02)	(0.01)	(0.00)	(0.00)	(0.04)	(0.04)
Land in ha_2006 (ln)	0.232**	0.025	0.209***	0.072	0.001	-0.015	0.581**	0.229
	(0.10)	(0.05)	(0.06)	(0.05)	(0.01)	(0.01)	(0.29)	(0.20)
Value of assets_2006 (ln)	0.201***	0.017	0.245***	0.044**	0.017	0.011	0.050	-0.151
	(0.04)	(0.03)	(0.06)	(0.02)	(0.02)	(0.01)	(0.13)	(0.12)
Dist. coop office (minutes)(ln)	-0.026	0.005	-0.107	0.009	0.025***	0.011	-0.253	-0.016
	(0.05)	(0.05)	(0.07)	(0.05)	(0.01)	(0.01)	(0.19)	(0.18)
Dist. asphalt road (minutes)(ln)	0.037	0.022	-0.096**	-0.012	-0.004	-0.004	0.091	0.023
	(0.04)	(0.03)	(0.05)	(0.04)	(0.01)	(0.01)	(0.15)	(0.12)
Increased input prices+	0.043	-0.126*	0.038	0.074	-0.061**	0.001	0.573	0.138
	(0.14)	(0.07)	(0.16)	(0.15)	(0.03)	(0.03)	(0.47)	(0.33)
Death/ loss of livestock+	-0.189	-0.063	-0.455***	-0.110	0.052*	0.028	0.536	0.368
	(0.12)	(0.07)	(0.16)	(0.10)	(0.03)	(0.03)	(0.50)	(0.51)
Illness of head/spouse+	-0.025	0.088	-0.020	0.207*	-0.056*	-0.051***	-0.514	-0.409
	(0.08)	(0.09)	(0.17)	(0.12)	(0.03)	(0.02)	(0.71)	(0.67)
Illness of other family+	-0.197***	-0.065	-0.238*	-0.064	-0.003	-0.048	-0.168	0.542
	(0.07)	(0.07)	(0.14)	(0.08)	(0.03)	(0.03)	(0.35)	(0.46)
Self-esteem		0.010		0.213***		-0.016		-0.084
		(0.08)		(0.05)		(0.03)		(0.33)
Subj. welbeing		-0.041		-0.064***		0.010		0.044
		(0.04)		(0.02)		(0.01)		(0.13)
Risk_lottery		0.006		0.027		-0.016*		-0.175
		(0.02)		(0.02)		(0.01)		(0.11)
Risk_Market		-0.005		-0.017		0.020		0.259*
		(0.01)		(0.03)		(0.01)		(0.15)
Present income(ln) (perceived)		0.887***						
		(0.04)						
Present v.assets(ln) (perceived)				0.721***				
				(0.05)				
Present s.status(ln) (perceived)						0.356***		
						(0.09)		
Present ch.education								0.339***
								(0.08)
Hettosa-Tiyyo+	-0.006	-0.377***	-0.056	-0.139*	-0.039	-0.026	-0.602	-0.682
	(0.11)	(0.10)	(0.10)	(0.08)	(0.03)	(0.02)	(0.57)	(0.50)
Adaa-Lume+	0.042	-0.196**	0.052	-0.019	-0.083*	-0.074***	-1.592***	-1.647***
	(0.10)	(0.09)	(0.09)	(0.09)	(0.05)	(0.03)	(0.30)	(0.20)
Constant	1.958	-0.835	5.507***	1.592	2.074*	2.613***	12.902	25.298**
	(1.29)	(0.87)	(1.62)	(1.05)	(1.11)	(0.64)	(9.72)	(12.16)
Observations	665	663	665	663	665	663	665	663
R-squared	0.231	0.593	0.290	0.604	0.079	0.386	0.122	0.252

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01. #Note: the following indicators were controlled but the coefficients were not statistically significant: distance to- market, FTC, nearest input dealer; dummies for experience of shocks including too much rain/flood, livestock diseases; and internal traits such as trust in others, locus of control, discount factor. +Binary

Table A2. 6. The effect of social interactions on aspirations: RG – village, all and richer
(Based on average outcome of all in the reference group as well as those with more than village average)#

	(1) AvAsp1	(2) AvAsp2	(3) AvAsp3	(4) AbovAv1	(5) AbovAv2	(6) AbovAv3
Village ave. Asp. Index	0.32	0.24	0.08			
	(0.29)	(0.33)	(0.30)			
Mean of Aspindex Above village av				0.54***	0.46***	0.40***
				(0.10)	(0.14)	(0.13)
Male+	0.22***	0.18***	0.09	0.22***	0.18***	0.10
	(0.07)	(0.06)	(0.07)	(0.07)	(0.06)	(0.06)
Age in years	0.02**	0.02**	0.01	0.02**	0.02***	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Square of age	-0.00*	-0.00*	-0.00	-0.00*	-0.00**	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education level	0.04***	0.03***	0.02**	0.04***	0.03***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Land in ha_2006 (ln)	0.10**	0.08*	0.00	0.09**	0.08*	0.00
	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Value of assets_2006 (ln)	0.09***	0.07***	0.01	0.10***	0.07***	0.02
	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
Illness of other family+	-0.15**	-0.12	-0.09	-0.14**	-0.11	-0.08
	(0.06)	(0.08)	(0.06)	(0.07)	(0.08)	(0.06)
Locus of control		0.18***	0.12*		0.19***	0.12*
		(0.07)	(0.07)		(0.07)	(0.07)
Trust		0.03***	0.03**		0.03**	0.03**
		(0.01)	(0.01)		(0.01)	(0.01)
Subj. welbeing		0.07***	0.01		0.07***	0.01
		(0.02)	(0.02)		(0.02)	(0.02)
Risk_lottery		-0.01	-0.02		-0.01	-0.02
		(0.02)	(0.02)		(0.02)	(0.02)
Risk_Market		0.01	0.02		0.01	0.02
		(0.02)	(0.02)		(0.02)	(0.02)
Present income(ln) (perceived)			0.24***			0.23***
			(0.02)			(0.02)
Present v.assets(ln) (perceived)			0.04			0.04
			(0.03)			(0.03)
Present s.status(ln) (perceived)			0.20***			0.19***
			(0.04)			(0.04)
Present ch.education			0.02***			0.02***
			(0.01)			(0.01)
Hettosa-Tiyyo+	-0.14**	-0.17***	-0.31***	-0.13***	-0.16***	-0.30***
	(0.07)	(0.06)	(0.06)	(0.04)	(0.04)	(0.02)
Adaa-Lume+	-0.10**	-0.13***	-0.20***	-0.12***	-0.15***	-0.21***
	(0.04)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)
Constant	-1.90***	-1.67***	-4.48***	-2.12***	-1.87***	-4.54***
	(0.27)	(0.27)	(0.52)	(0.25)	(0.26)	(0.53)
Observations	665	663	663	665	663	663
R-squared	0.193	0.236	0.331	0.208	0.247	0.340

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01. #Note: the following indicators were controlled but the coefficients were not statistically significant: distance to- market, asphalt road, nearest input dealer, coop office, FTC; ; dummies for experience of shocks including too much rain/flood, livestock diseases; death/loss of livestock, increased input prices, illness of household head/spouse; and internal traits such as self-esteem, and discount factor. +Binary

Table A2. 7. The effect of social interactions on aspirations (IV estimates)
(Using average outcome of all in the reference group)#

	(1) r1	(2) r2	(3) r3	(4) r4	(5) r5	(6) r6
Village ave. Asp. Index	0.70*	0.76*	0.79**	0.98***	0.81**	0.59*
	(0.38)	(0.39)	(0.34)	(0.29)	(0.34)	(0.34)
Male	0.23***	0.23***	0.22***	0.18***	0.19***	0.11*
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Age in years	0.01	0.01	0.01	0.01	0.01	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Square of age	0.00	0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education level	0.03***	0.04***	0.04***	0.03***	0.03***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HH size	0.28***	0.29***	0.30***	0.29***	0.31***	0.07*
	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)
Dependency ratio	-0.09	-0.09	-0.07	-0.07	-0.02	0.08
	(0.12)	(0.11)	(0.12)	(0.11)	(0.11)	(0.10)
Land in ha_2006 (ln)	0.05	0.05	0.05	0.05	0.02	0.01
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Value of assets_2006 (ln)	0.08***	0.08***	0.08***	0.07***	0.04*	0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Dist. coop office (minutes)(ln)		0.03	0.04*	0.04*	0.04**	0.05**
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Dist. FTC (minutes)(ln)		-0.04	-0.05	-0.05	-0.06	-0.07*
		(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Illness of other family			-0.13***	-0.10**	-0.10**	-0.09**
			(0.04)	(0.05)	(0.04)	(0.04)
Locus of control				0.18***	0.16***	0.11*
				(0.06)	(0.06)	(0.06)
Trust index				0.03**	0.04***	0.03*
				(0.01)	(0.01)	(0.02)
Risk_composite				-0.00	-0.01	-0.00
				(0.01)	(0.01)	(0.01)
Real PC expenditure2014(ln)					0.14***	
					(0.03)	
Value of assets_14(ln)					0.04	
					(0.02)	
Present income(ln) (perceived)						0.22***
						(0.02)
Present v.assets(ln) (perceived)						0.04
						(0.02)
Present s.status(ln) (perceived)						0.20***
						(0.04)
Present ch.education						0.02**
						(0.01)
Hettosa-Tiyyo	-0.07*	-0.10***	-0.13***	-0.15***	-0.22***	-0.29***
	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)
Adaa-Lume	0.01	-0.03	-0.07*	-0.10**	-0.16***	-0.17***
	(0.03)	(0.04)	(0.03)	(0.04)	(0.05)	(0.04)
Constant	-1.71***	-1.84***	-1.88***	-1.77***	-2.52***	-4.33***
	(0.28)	(0.32)	(0.34)	(0.33)	(0.28)	(0.54)
Observations	649	649	649	647	647	647
r2	0.20	0.21	0.22	0.24	0.26	0.32

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. #Note: the following indicators were controlled but the coefficients were not statistically significant: distance to- market, asphalt road, nearest input dealer, FTC; dummies for experience of shocks including too much rain/flood, livestock diseases; death/loss of livestock, increased input prices, illness of household head/spouse; and discount factor. +Binary

Table A2. 8. The effect of social interactions on aspirations across gender (IV estimates)

	(1) r2f	(2) r3f	(3) r4f	(4) r5f	(5) r2m	(6) r3m	(7) r4m	(8) r5m
Village ave. Asp. Index	1.12***	1.16***	1.45***	0.87***	0.28	0.29	0.23	0.04
	(0.37)	(0.37)	(0.39)	(0.27)	(1.00)	(0.89)	(0.91)	(0.87)
Age in years	0.02**	0.02**	0.03**	0.01	-0.01	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Square of age	-0.00*	-0.00**	-0.00*	-0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education level	0.03***	0.04***	0.02**	0.01	0.04***	0.04***	0.04***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HH size	0.20***	0.21***	0.16**	-0.04	0.41***	0.41***	0.44***	0.23***
	(0.06)	(0.07)	(0.08)	(0.07)	(0.08)	(0.07)	(0.06)	(0.06)
Dependency ratio	-0.07	-0.03	-0.03	0.12	-0.15*	-0.16	-0.19*	-0.07
	(0.17)	(0.17)	(0.14)	(0.15)	(0.09)	(0.11)	(0.10)	(0.09)
Land in ha_2006 (ln)	0.03	0.02	0.03	-0.01	0.06	0.07	0.06	0.03
	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.07)	(0.07)	(0.06)
Value of assets_2006 (ln)	0.04*	0.04**	0.04**	0.01	0.11***	0.11***	0.11***	0.04
	(0.07)	(0.07)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)
Dist. coop office (minutes)(ln)	0.03	0.03	0.03	0.04**	0.03	0.03	0.04	0.05
	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.04)	(0.03)	(0.04)
Dist. FTC (minutes)(ln)	-0.10*	-0.10**	-0.10**	-0.11**	0.02	0.02	0.02	-0.01
	(0.05)	(0.05)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)
Livestock diseases+		0.02	0.01	-0.05		-0.16	-0.12	-0.18*
		(0.08)	(0.09)	(0.08)		(0.11)	(0.12)	(0.11)
Illness of other family+		-0.17**	-0.15***	-0.12**		-0.07	-0.05	-0.06
		(0.07)	(0.05)	(0.05)		(0.09)	(0.07)	(0.06)
Locus of control			0.26***	0.19**			0.02	-0.06
			(0.07)	(0.07)			(0.11)	(0.12)
Trust index			0.00	0.01			0.08**	0.07**
			(0.03)	(0.02)			(0.03)	(0.03)
Discount factor			0.05***	0.05***			-0.01	-0.01
			(0.02)	(0.02)			(0.02)	(0.02)
Risk_composite			-0.00	-0.00			0.00	0.00
			(0.01)	(0.01)			(0.01)	(0.01)
Present income(ln) (perceived)				0.18***				0.24***
				(0.06)				(0.04)
Present v.assets(ln) (perceived)				0.02				0.05
				(0.04)				(0.04)
Present s.status(ln) (perceived)				0.19***				0.18***
				(0.05)				(0.04)
Present ch.education				0.02***				0.01
				(0.01)				(0.01)
Hettosa-Tiyyo+	-0.02	-0.05	-0.09	-0.2***	-0.18	-0.21**	-0.22**	-0.36***
	(0.04)	(0.05)	(0.08)	(0.04)	(0.11)	(0.10)	(0.09)	(0.07)
Adaa-Lume+	-0.03	-0.06	-0.13*	-0.2***	-0.04	-0.07	-0.06	-0.17***
	(0.04)	(0.05)	(0.08)	(0.05)	(0.10)	(0.07)	(0.06)	(0.05)
Constant	-1.5***	-1.58***	-1.42***	-3.4***	-1.9***	-1.8***	-1.7***	-4.71***
	(0.38)	(0.37)	(0.33)	(0.53)	(0.59)	(0.60)	(0.61)	(1.01)
Observations	332	332	332	332	317	317	315	315
r2	0.08	0.09	0.16	0.24	0.22	0.23	0.24	0.33

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. #Note: the following indicators were controlled but the coefficients were not statistically significant: distance to- market, asphalt road, nearest input dealer; dummies for experience of shocks including too much rain/flood, death/loss of livestock, increased input prices, illness of household head/spouse. +Binary

Table A2. 9. The effect of aspirations-gap on risk aversion

	(1) Lottery1	(2) Lottery2	(3) Market1	(4) Market2	(5) Lottery3	(6) Lottery4	(7) Market3	(8) Market4
Asp.Gap index	0.21*	0.18	0.08	0.05				
	(0.12)	(0.12)	(0.10)	(0.10)				
Squ.of Asp.Gap~x	-0.02*	-0.02	-0.01	-0.01				
	(0.01)	(0.01)	(0.01)	(0.01)				
Wide Asp.Gap					-0.47**	-0.49**	-0.37*	-0.38*
					(0.21)	(0.21)	(0.20)	(0.20)
Narrow Asp.Gap					-0.65***	-0.62***	-0.36**	-0.32*
					(0.18)	(0.18)	(0.17)	(0.17)
Male+	0.58***	0.56***	0.41***	0.39***	0.53***	0.51***	0.38***	0.37***
	(0.14)	(0.14)	(0.13)	(0.13)	(0.14)	(0.14)	(0.13)	(0.13)
Age in years	0.07**	0.07**	0.05	0.05	0.07**	0.07**	0.05	0.05
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Square of age	-0.00**	-0.00**	-0.00	-0.00	-0.00**	-0.00**	-0.00*	-0.00*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education level	-0.01	-0.00	-0.04***	-0.04**	-0.01	-0.00	-0.04***	-0.04**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
HH size	0.06	0.04	0.12	0.10	0.05	0.03	0.11	0.10
	(0.18)	(0.18)	(0.16)	(0.16)	(0.18)	(0.17)	(0.16)	(0.16)
Dependency ratio	-0.02	0.02	0.01	0.04	-0.02	0.02	0.01	0.04
	(0.34)	(0.33)	(0.31)	(0.31)	(0.33)	(0.33)	(0.31)	(0.30)
Land in ha_2014 (ln)	0.04	0.07	-0.03	-0.01	0.06	0.08	-0.02	-0.01
	(0.09)	(0.09)	(0.08)	(0.08)	(0.09)	(0.09)	(0.08)	(0.08)
Relative wealth status	0.09	0.05	-0.19	-0.24	0.15	0.12	-0.15	-0.20
	(0.27)	(0.25)	(0.24)	(0.23)	(0.25)	(0.23)	(0.24)	(0.23)
Too much rain or flood+	-0.52**	-0.51**	-0.11	-0.11	-0.56**	-0.55**	-0.14	-0.13
	(0.23)	(0.23)	(0.20)	(0.21)	(0.23)	(0.23)	(0.21)	(0.21)
Livestock diseases+	0.00	-0.00	-0.19	-0.20	-0.07	-0.07	-0.23	-0.24
	(0.24)	(0.24)	(0.19)	(0.21)	(0.24)	(0.24)	(0.19)	(0.21)
Increased input prices+	0.52**	0.48**	0.50***	0.47**	0.48**	0.44**	0.47**	0.44**
	(0.20)	(0.20)	(0.19)	(0.20)	(0.20)	(0.20)	(0.19)	(0.20)
Death/ loss of livestock+	-0.01	0.01	0.09	0.12	0.04	0.06	0.12	0.14
	(0.22)	(0.22)	(0.17)	(0.17)	(0.22)	(0.22)	(0.18)	(0.18)
Illness of head/spouse+	0.21	0.31	0.02	0.11	0.22	0.32	0.03	0.13
	(0.22)	(0.22)	(0.21)	(0.21)	(0.21)	(0.21)	(0.20)	(0.20)
Illness of other family+	-0.18	-0.18	-0.36*	-0.36*	-0.16	-0.15	-0.35*	-0.35*
	(0.22)	(0.22)	(0.19)	(0.19)	(0.22)	(0.22)	(0.19)	(0.19)
Average value of others' assets (ln)	0.22	0.04	-0.10	-0.35	0.23	0.06	-0.09	-0.33
	(0.30)	(0.35)	(0.27)	(0.32)	(0.29)	(0.34)	(0.27)	(0.31)
Average landholdings of others'	-0.23	-0.33*	0.05	-0.07	-0.22	-0.30	0.06	-0.06
	(0.19)	(0.19)	(0.16)	(0.17)	(0.18)	(0.19)	(0.16)	(0.17)
Dist. market (minutes)(ln)		0.20**		0.18***		0.19**		0.18***
		(0.08)		(0.07)		(0.08)		(0.07)
Dist. coop office (minutes)(ln)		-0.01		0.04		-0.02		0.03
		(0.08)		(0.06)		(0.08)		(0.06)
Dist. Micro finance (minutes)(ln)		-0.18		-0.20*		-0.19*		-0.20*
		(0.11)		(0.10)		(0.11)		(0.10)
Hettosa-Tiyyo+	-0.40	-0.16	-0.35	-0.06	-0.44*	-0.20	-0.37	-0.08
	(0.27)	(0.31)	(0.24)	(0.29)	(0.26)	(0.30)	(0.24)	(0.29)
Adaa-Lume+	-0.42	-0.24	-0.40	-0.13	-0.47	-0.28	-0.43	-0.16
	(0.30)	(0.37)	(0.28)	(0.34)	(0.29)	(0.36)	(0.28)	(0.34)
Constant	-0.50	1.40	2.78	5.42	-0.18	1.72	2.92	5.54
	(3.13)	(3.79)	(2.91)	(3.50)	(3.05)	(3.65)	(2.86)	(3.45)
Observations	666	666	666	666	666	666	666	666
r2	0.08	0.10	0.06	0.08	0.10	0.11	0.07	0.08

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. +Binary

Table A2. 10. The effect of aspirations-gap on time discounting

	(1) DisFact11	(2) DisFact12	(3) DisFact21	(4) DisFact22
Asp.Gap index	0.35**	0.38**		
	(0.16)	(0.16)		
Squ.of Asp.Gap index	-0.04**	-0.04**		
	(0.02)	(0.02)		
Wide Asp.Gap			0.32	0.35
			(0.27)	(0.27)
Narrow Asp.Gap			0.15	0.14
			(0.20)	(0.20)
Risk (composite index)	0.03	0.04	0.03	0.04
	(0.03)	(0.03)	(0.03)	(0.03)
Risk*Asp.Gap	-0.01	-0.01	-0.01	-0.01
	(0.02)	(0.02)	(0.01)	(0.01)
Male+	-0.22	-0.22	-0.18	-0.18
	(0.16)	(0.16)	(0.16)	(0.16)
Age in years	0.03	0.03	0.04	0.04
	(0.04)	(0.04)	(0.04)	(0.04)
Square of age	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Education level	0.08***	0.08***	0.08***	0.08***
	(0.02)	(0.02)	(0.02)	(0.02)
HH size	-0.02	0.01	-0.01	0.02
	(0.20)	(0.20)	(0.20)	(0.20)
Dependency ratio	-0.26	-0.31	-0.26	-0.31
	(0.39)	(0.39)	(0.39)	(0.39)
Land in ha_2014 (ln)	-0.02	-0.05	-0.02	-0.06
	(0.11)	(0.11)	(0.11)	(0.11)
Relative wealth status	0.62*	0.64*	0.55	0.57
	(0.36)	(0.36)	(0.35)	(0.35)
Too much rain or flood+	-0.17	-0.18	-0.17	-0.18
	(0.25)	(0.25)	(0.25)	(0.25)
Livestock diseases+	0.39	0.38	0.41	0.39
	(0.28)	(0.28)	(0.27)	(0.28)
Increased input prices+	-0.11	-0.07	-0.10	-0.06
	(0.25)	(0.25)	(0.25)	(0.25)
Death/ loss of livestock+	0.47*	0.45*	0.46*	0.44*
	(0.25)	(0.25)	(0.25)	(0.25)
Illness of head/spouse+	0.51*	0.41	0.48	0.38
	(0.30)	(0.30)	(0.30)	(0.30)
Illness of other family+	-0.04	-0.03	-0.06	-0.05
	(0.26)	(0.26)	(0.26)	(0.26)
Average value of others' assets (ln)	0.09	0.08	0.11	0.10
	(0.36)	(0.40)	(0.36)	(0.40)
Average landholdings of others'	-0.40*	-0.34	-0.38*	-0.33
	(0.21)	(0.22)	(0.21)	(0.22)
Dist. market (minutes)(ln)		-0.21**		-0.20**
		(0.09)		(0.09)
Dist. coop office (minutes)(ln)		0.09		0.10
		(0.08)		(0.08)
Dist. Micro finance (minutes)(ln)		0.12		0.12
		(0.11)		(0.11)
Hettosa-Tiyyo+	0.22	0.12	0.17	0.08
	(0.30)	(0.33)	(0.30)	(0.33)
Adaa-Lume+	0.52	0.53	0.48	0.50
	(0.35)	(0.41)	(0.35)	(0.41)
Constant	-0.75	-0.82	-0.98	-1.03
	(3.73)	(4.33)	(3.74)	(4.34)
Observations	666	666	666	666
r2	0.08	0.08	0.07	0.08

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. +Binary

Table A2. 11. The effect of aspirations-gap on risk aversion across gender

	(1) LotteryF1	(2) MarketF1	(3) LotteryF2	(4) MarketF2	(5) LotteryM1	(6) MarketM1	(7) LotteryM2	(8) MarketM2
Asp.Gap index	0.37*	0.20			0.12	-0.03		
	(0.20)	(0.18)			(0.14)	(0.13)		
Squ.of Asp.Gap index	-0.05**	-0.02			-0.01	-0.00		
	(0.02)	(0.02)			(0.02)	(0.02)		
Wide Asp.Gap			-0.37	-0.47			-0.60**	-0.36
			(0.38)	(0.34)			(0.24)	(0.24)
Narrow Asp.Gap			-0.62**	-0.52**			-0.70***	-0.21
			(0.29)	(0.26)			(0.22)	(0.21)
Age in years	0.09**	0.07	0.10**	0.07	0.08*	0.11**	0.08*	0.11**
	(0.04)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Square of age	-0.00**	-0.00	-0.00**	-0.00	-0.00**	-0.00**	-0.00**	-0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education level	0.04	0.02	0.03	0.02	-0.03	-0.08***	-0.03	-0.08***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
HH size	-0.08	0.04	-0.08	0.03	0.03	0.03	0.03	0.02
	(0.23)	(0.24)	(0.23)	(0.24)	(0.26)	(0.25)	(0.26)	(0.25)
Dependency ratio	-0.54	-0.03	-0.62	-0.07	0.81	0.45	0.88*	0.47
	(0.46)	(0.45)	(0.46)	(0.45)	(0.50)	(0.43)	(0.48)	(0.43)
Land in ha_2014 (ln)	0.08	0.03	0.05	0.01	0.09	-0.04	0.12	-0.03
	(0.13)	(0.13)	(0.13)	(0.12)	(0.12)	(0.11)	(0.12)	(0.11)
Relative wealth	0.10	-0.03	0.08	0.03	-0.03	-0.65**	0.09	-0.61**
	(0.38)	(0.41)	(0.39)	(0.41)	(0.41)	(0.31)	(0.39)	(0.30)
Too much rain or flood+	-0.62*	-0.09	-0.66*	-0.15	-0.36	-0.08	-0.36	-0.09
	(0.34)	(0.33)	(0.34)	(0.33)	(0.32)	(0.31)	(0.31)	(0.31)
Livestock diseases+	0.06	-0.26	0.06	-0.29	0.04	-0.05	-0.09	-0.09
	(0.35)	(0.32)	(0.36)	(0.32)	(0.28)	(0.29)	(0.27)	(0.29)
Increased input prices+	0.22	0.22	0.20	0.19	0.68**	0.75***	0.69**	0.73***
	(0.31)	(0.30)	(0.31)	(0.30)	(0.28)	(0.27)	(0.28)	(0.27)
Death/ loss of livestock+	-0.26	-0.16	-0.23	-0.13	0.28	0.43	0.34	0.44
	(0.30)	(0.27)	(0.30)	(0.28)	(0.28)	(0.27)	(0.29)	(0.28)
Illness of head/spouse+	0.30	-0.17	0.26	-0.16	0.34	0.39	0.38	0.39
	(0.35)	(0.31)	(0.36)	(0.31)	(0.27)	(0.28)	(0.26)	(0.27)
Illness of other family+	-0.18	-0.25	-0.13	-0.19	-0.29	-0.62**	-0.31	-0.64**
	(0.30)	(0.30)	(0.30)	(0.30)	(0.29)	(0.25)	(0.28)	(0.25)
Average value of others' assets (ln)	0.49	-0.03	0.47	-0.03	-0.36	-0.69	-0.34	-0.63
	(0.51)	(0.48)	(0.50)	(0.48)	(0.48)	(0.43)	(0.46)	(0.42)
Average landholdings of others'	-0.26	0.02	-0.24	0.03	-0.40	-0.14	-0.35	-0.11
	(0.28)	(0.26)	(0.28)	(0.25)	(0.27)	(0.23)	(0.27)	(0.24)
Dist. market (minutes)(ln)	0.19	0.11	0.14	0.09	0.24**	0.27***	0.25**	0.28***
	(0.12)	(0.10)	(0.12)	(0.10)	(0.11)	(0.10)	(0.11)	(0.10)
Dist. coop office (minutes)(ln)	0.07	0.09	0.09	0.10	-0.11	-0.02	-0.14	-0.04
	(0.11)	(0.09)	(0.11)	(0.09)	(0.10)	(0.09)	(0.10)	(0.09)
Dist. Micro finance (minutes)(ln)	-0.10	-0.19	-0.13	-0.21	-0.23	-0.17	-0.23	-0.17
	(0.16)	(0.14)	(0.16)	(0.13)	(0.15)	(0.16)	(0.15)	(0.16)
Hettosa-Tiyyo+	-0.93**	-0.73*	-0.96**	-0.76*	0.54	0.52	0.50	0.48
	(0.44)	(0.42)	(0.44)	(0.41)	(0.42)	(0.38)	(0.41)	(0.38)
Adaa-Lume+	-1.03*	-0.63	-0.99*	-0.60	0.45	0.25	0.37	0.17
	(0.53)	(0.51)	(0.52)	(0.50)	(0.53)	(0.49)	(0.52)	(0.48)
Constant	-3.58	1.66	-2.51	2.29	5.68	8.34*	5.79	7.86*
	(5.41)	(5.20)	(5.35)	(5.15)	(5.12)	(4.74)	(4.96)	(4.63)
Observations	342	342	342	342	324	324	324	324
r2	0.11	0.09	0.11	0.09	0.08	0.14	0.11	0.15

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. +Binary

Table A2. 12. The effect of aspirations-gap on time discounting across gender

	(1) DisFactF1	(2) DisFactF2	(3) DisFactM1	(4) DisFactM2
Asp.Gap index	0.48*		0.19	
	(0.27)		(0.24)	
Squ.of Asp.Gap index	-0.01		-0.06***	
	(0.03)		(0.02)	
Wide Asp.Gap+		0.61		0.18
		(0.50)		(0.36)
Narrow Asp.Gap+		0.63*		-0.16
		(0.32)		(0.29)
Risk (composite index)	0.10**	0.05	-0.04	0.01
	(0.05)	(0.04)	(0.05)	(0.04)
Risk*Asp.Gap	-0.06*	0.01	0.03	-0.02
	(0.04)	(0.02)	(0.02)	(0.01)
Age in years	0.03	0.01	0.08	0.09
	(0.06)	(0.06)	(0.07)	(0.07)
Square of age	-0.00	0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Education level	0.09***	0.09***	0.07**	0.07**
	(0.03)	(0.03)	(0.03)	(0.03)
HH size	0.23	0.28	-0.25	-0.24
	(0.28)	(0.28)	(0.31)	(0.32)
Dependency ratio	-0.15	-0.13	-0.13	-0.24
	(0.54)	(0.53)	(0.57)	(0.58)
Land in ha_2014 (ln)	-0.08	-0.06	-0.06	-0.05
	(0.15)	(0.14)	(0.17)	(0.17)
Relative wealth	0.80**	0.67*	0.37	0.25
	(0.39)	(0.38)	(0.56)	(0.57)
Too much rain or flood+	-0.28	-0.23	-0.01	-0.04
	(0.39)	(0.38)	(0.35)	(0.35)
Livestock diseases+	0.40	0.42	0.35	0.35
	(0.35)	(0.35)	(0.41)	(0.41)
Increased input prices+	-0.15	-0.03	0.05	0.04
	(0.35)	(0.35)	(0.36)	(0.36)
Death/ loss of livestock+	0.37	0.29	0.70**	0.67*
	(0.33)	(0.34)	(0.34)	(0.34)
Illness of head/spouse+	0.39	0.36	0.35	0.44
	(0.39)	(0.38)	(0.39)	(0.38)
Illness of other family+	-0.10	-0.20	-0.03	-0.01
	(0.33)	(0.34)	(0.38)	(0.39)
Average value of others' assets (ln)	0.34	0.32	-0.16	-0.21
	(0.56)	(0.56)	(0.61)	(0.60)
Average landholdings of others'	-0.33	-0.31	-0.38	-0.31
	(0.27)	(0.27)	(0.32)	(0.32)
Dist. market (minutes)(ln)	-0.27**	-0.24**	-0.16	-0.15
	(0.11)	(0.11)	(0.14)	(0.14)
Dist. coop office (minutes)(ln)	0.10	0.10	0.10	0.09
	(0.11)	(0.11)	(0.13)	(0.13)
Dist. Micro finance (minutes)(ln)	0.27*	0.29*	-0.03	-0.06
	(0.16)	(0.17)	(0.16)	(0.17)
Hettosa-Tiyyo+	0.00	0.03	0.20	0.19
	(0.49)	(0.49)	(0.50)	(0.50)
Adaa-Lume+	0.49	0.44	0.58	0.57
	(0.60)	(0.60)	(0.62)	(0.62)
Constant	-4.68	-4.48	1.91	2.46
	(6.03)	(6.02)	(6.50)	(6.50)
Observations	342	342	324	324
r2	0.12	0.12	0.10	0.07

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. + Binary

Table A2. 13. Balancing test

Variable	Unmatched Matched	Mean Treated	Mean Control	%bias	%reduct |bias|	t	t-test p>|t|	V(T)/ V(C)
Male+	U	.62376	.46341	32.5		2.99	0.003	.
	M	.63636	.61158	5.0	84.5	0.36	0.721	.
Age in years	U	45.47	46.415	-7.3		-0.67	0.506	0.93
	M	45.51	45.35	1.2	83.0	0.09	0.930	0.98
Square of age	U	2229.3	2328.8	-7.8		-0.70	0.486	0.82
	M	2230.6	2219.6	0.9	89.0	0.06	0.951	0.87
Education	U	4.1287	3.6876	11.7		1.05	0.296	0.83
	M	4.1515	4.171	-0.5	95.6	-0.04	0.972	0.79
HH size	U	1.8563	1.8666	-2.6		-0.25	0.801	1.26
	M	1.8601	1.8661	-1.5	41.5	-0.11	0.915	1.22
Dependency ratio	U	.38671	.39077	-1.9		-0.18	0.856	1.07
	M	.38515	.39247	-3.5	-80.4	-0.24	0.808	1.08
Land in ha_2014 (ln)	U	.43152	.5587	-14.8		-1.46	0.146	1.40
	M	.42566	.45481	-3.4	77.1	-0.23	0.818	1.21
V.of assets_2014 (ln)	U	9.1886	9.5118	-27.6		-2.68	0.008	1.28
	M	9.2295	9.2655	-3.1	88.9	-0.21	0.835	0.96
Dist. market (minutes)(ln)	U	3.9873	3.8238	18.8		1.68	0.093	0.81
	M	3.9911	4.0088	-2.0	89.1	-0.15	0.879	0.94
Dist. coop office (minutes)(ln)	U	3.2376	3.11	13.5		1.25	0.211	0.99
	M	3.2738	3.2625	1.2	91.2	0.09	0.931	0.99
Dist. micro-finance (minutes)(ln)	U	4.3421	4.3254	2.6		0.23	0.816	0.87
	M	4.3387	4.3501	-1.7	32.0	-0.12	0.902	0.93
Too much rain or flood+	U	.10891	.0784	10.5		1.02	0.306	.
	M	.11111	.11016	0.3	96.9	0.02	0.983	.
Livestock diseases+	U	.11881	.0784	13.5		1.35	0.178	.
	M	.12121	.10905	4.1	69.9	0.27	0.790	.
Increased input prices+	U	.14851	.0993	14.9		1.48	0.140	.
	M	.15152	.14199	2.9	80.6	0.19	0.851	.
Death/ loss of livestock+	U	.06931	.10105	-11.4		-1.00	0.319	.
	M	.07071	.07596	-1.9	83.4	-0.14	0.888	.
Illness of head/spouse+	U	.09901	.08885	3.5		0.33	0.743	.
	M	.10101	.08396	5.8	-67.8	0.41	0.681	.
Illness of other family+	U	.08911	.09756	-2.9		-0.27	0.791	.
	M	.09091	.08588	1.7	40.5	0.12	0.902	.
Village average livestock holdings	U	8.2467	8.2183	1.8		0.17	0.864	1.01
	M	8.2516	8.255	-0.2	88.0	-0.02	0.988	0.90
Hettosa-Tiyyo+	U	.28713	.32692	-8.6		-0.79	0.430	.
	M	.28283	.29001	-1.6	82.0	-0.11	0.912	.
Adaa-Lume+	U	.35644	.33392	4.7		0.44	0.660	.
	M	.35354	.35403	-0.1	97.8	-0.01	0.994	.

* if variance ratio outside [0.67; 1.48] for U and [0.67; 1.49] for M

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Unmatched	0.058	32.36	0.040	10.6	9.5	63.2*	0.98	0
Matched	0.002	0.68	1.000	2.1	1.7	11.7	1.22	0

* if B>25%, R outside [0.5; 2]

Table A2. 14. Some statistical tests of validity of the instrumental variables

(a) Test of relevance

Av. pa(village)	Asp. of Others'(avpa_aspO)	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Av. pa. Suj.wellbeing_life ladder (2006)		**.1323546**	**.0146828**	**9.01**	**0.000**	**.1035216**	**.1611876**
Av. pa. Suj.wellbeing_compared to others		**.1587981**	**.0409877**	**3.87**	**0.000**	**.0783093**	**.239287**
Av. pa_father's role in institutions		**-.0984704**	**.0082981**	**-11.87**	**0.000**	**-.1147656**	**-.0821753**
Male+		.0023229	.0061436	0.38	0.705	-.0097414	.0143872
Age in years		.000859	.001467	0.59	0.558	-.0020218	.0037399
Square of age		-8.95e-06	.0000147	-0.61	0.544	-.0000379	.00002
Education		-.0025291	.0007931	-3.19	0.001	-.0040866	-.0009717
Land in ha_2006(ln)		-.0039661	.0042436	-0.93	0.350	-.0122994	.0043671
V.of assets_2006(ln)		-.0025567	.0028467	-0.90	0.369	-.0081469	.0030334
Too much rain or flood+		-.0045306	.0095225	-0.48	0.634	-.0232302	.0141691
Livestock diseases+		-.0365511	.0095653	-3.82	0.000	-.0553348	-.0177675
Large increases in input prices+		-.0004645	.0092878	-0.05	0.960	-.0187032	.0177742
Death or loss of livestock+		.0045059	.0101111	0.45	0.656	-.0153496	.0243613
Illness of head/spouse+		-.0018514	.0077537	-0.24	0.811	-.0170775	.0133748
Illness of other family member+		-.0096447	.0089525	-1.08	0.282	-.0272251	.0079357
Hettosa-Tiyyo+		.1046634	.0104249	10.04	0.000	.0841917	.1251351
Adaa-Lume+		.0355502	.0094982	3.74	0.000	.0168984	.054202
Constant		.4940375	.0946188	5.22	0.000	.3082317	.6798432

(b) Falsification test

Aspirations index	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Av. pa. Suj.wellbeing_life ladder (2006)	**.0753665**	**.1461738**	**0.52**	**0.606**	**-.2116795**	**.3624126**
Av. pa. Suj.wellbeing_compared to others	**.2446056**	**.2700207**	**0.91**	**0.365**	**-.2856423**	**.7748534**
Av. pa_father's role in institutions	**-.0906903**	**.0728579**	**-1.24**	**0.214**	**-.2337636**	**.052383**
Male+	.2395989	.0505462	4.74	0.000	.1403398	.338858
Age in years	.0175402	.0124545	1.41	0.160	-.006917	.0419975
Square of age	-.000129	.000123	-1.05	0.295	-.0003706	.0001126
Education	.033464	.0074052	4.52	0.000	.0189223	.0480058
Land in ha_2006(ln)	.0988868	.0363311	2.72	0.007	.0275422	.1702313
V.of assets_2006(ln)	.092758	.0245879	3.77	0.000	.0444739	.141042
Too much rain or flood+	-.0192617	.0966317	-0.20	0.842	-.2090203	.1704969
Livestock diseases+	-.0614505	.0773065	-0.79	0.427	-.2132597	.0903587
Large increases in input prices+	.0021689	.0937402	0.02	0.982	-.1819116	.1862495
Death or loss of livestock+	-.057196	.0647993	-0.88	0.378	-.1844443	.0700523
Illness of head/spouse+	.0190184	.0993325	0.19	0.848	-.1760439	.2140807
Illness of other family member+	-.1451515	.0735098	-1.97	0.049	-.289505	-.000798
Hettosa-Tiyyo+	-.0215225	.1012868	-0.21	0.832	-.2204225	.1773775
Adaa-Lume+	-.0130574	.0818046	-0.16	0.873	-.1736997	.1475848
Constant	-.9194455	.7643331	-1.20	0.229	-2.42039	.5814989

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. +Binary

(c) Formal tests of instrument validity

First-stage regression summary statistics

Variable	R-sq.	Adjusted R-sq.	Partial R-sq.	F(3,626)	Prob > F
avpa_aspO	0.3422	0.3191	0.2702	69.8683	0.0000

Shea's partial R-squared

Variable	Shea's Partial R-sq.	Shea's Adj. Partial R-sq.
avpa_aspO	0.2702	0.2458

Minimum eigenvalue statistic = 77.2641

Critical Values # of endogenous regressors: 1
Ho: Instruments are weak # of excluded instruments: 3

	5%	10%	20%	30%
2SLS relative bias	13.91	9.08	6.46	5.39

	10%	15%	20%	25%
2SLS Size of nominal 5% Wald test	22.30	12.83	9.54	7.80
LIML Size of nominal 5% Wald test	6.46	4.36	3.69	3.32

Tests of endogeneity

Ho: variables are exogenous
Robust score chi2(1) = 1.39878 (p = 0.2369)
Robust regression F(1,627) = 1.35711 (p = 0.2445)

estat overid

Test of overidentifying restrictions:

Score chi2(2) = .031337 (p = 0.9845)

Table A3. 1. Determinants of learning links (using random matching within network data)

(Dependent variable: 1 if i discusses farming or business matters with j, 0 otherwise)

	(1) ALL	(2) MALE	(3) FEMALE	(4) HH_HEAD1	(5) HH_HEAD2
Same iddir+	0.34***	0.21*	0.41**	0.27**	0.26**
	(0.10)	(0.12)	(0.16)	(0.12)	(0.12)
Help when in need+	0.62***	0.60***	0.69***	0.62***	0.60***
	(0.10)	(0.13)	(0.16)	(0.12)	(0.13)
Related(blood/marriage)+	0.52***	0.49***	0.67***	0.48***	0.46***
	(0.12)	(0.18)	(0.17)	(0.17)	(0.17)
Meeting frequency	0.00***	0.00***	0.00	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Geo.dist.(i,j)(ln)	-0.11**	-0.15**	-0.12	-0.11	-0.10
	(0.06)	(0.07)	(0.08)	(0.07)	(0.07)
Radio listening (frequency)	0.00	0.00***	-0.00*	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Tv watching(frequency)	0.00***	0.00**	0.00**	0.00**	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Diff. gender dummies	-0.12	-0.90***	-0.22	-0.61***	-0.41***
	(0.07)	(0.11)	(0.14)	(0.10)	(0.16)
Diff. of age (i,j)	0.01***	0.01*	0.02***	0.00	0.01
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Diff. educ (i,j)	0.02	0.00	0.04**	0.00	0.00
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Diff. no. of men	0.06	0.02	0.08	0.05	0.05
	(0.03)	(0.04)	(0.06)	(0.04)	(0.04)
Diff. land size	-0.04*	-0.06*	0.02	-0.05	-0.05
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)
Diff. treatment status	0.07	0.06	0.07	0.05	0.08
	(0.07)	(0.10)	(0.11)	(0.09)	(0.09)
Sum gender dummies	0.47***	0.00	0.00		0.46***
	(0.08)	(.)	(.)		(0.16)
Sum of age (i,j)	0.00	-0.00	0.00		-0.00
	(0.00)	(0.00)	(0.01)		(0.00)
Sum of educ (i,j)	-0.00	-0.01	-0.00		-0.01
	(0.01)	(0.01)	(0.01)		(0.01)
Sum no. of men	0.00	-0.02	0.01		0.01
	(0.03)	(0.04)	(0.05)		(0.04)
Sum of land size	0.03	0.03	0.03		0.04
	(0.02)	(0.03)	(0.04)		(0.03)
Sum treatment status	0.09	0.13	0.06		0.14*
	(0.07)	(0.08)	(0.11)		(0.08)
Hettosa-Tiyyo +	0.05	0.06	-0.14	0.03	0.17
	(0.15)	(0.19)	(0.25)	(0.18)	(0.19)
Adaa-Lume+	0.08	-0.09	0.06	-0.12	-0.07
	(0.15)	(0.18)	(0.24)	(0.17)	(0.18)
Constant	-2.63***	-1.45***	-2.58***	-1.55***	-2.43***
	(0.40)	(0.53)	(0.74)	(0.31)	(0.55)
Observations	2339	1285	1054	1402	1402
Log lik.	-878.66	-530.65	-302.75	-601.37	-584.79

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses (clustered at individual and match's level for columns 1-3, and at individual and household level for columns 4-5). +Binary outcome. Other controls include same religion, same ethnicity, frequency of travel to nearest town, having plots nearby, the sum and difference of household size (neither of which are significant).

Table A3. 2. Determinants of learning links (using self-reported networks)

(Dependent variable: 1 if i discusses farming or business matters with j, 0 otherwise)

	(1) ALL	(2) MALE	(3) FEMALE	(4) HH_HEAD
Same gender+	0.65***	0.55***	0.38***	0.51***
	(0.11)	(0.18)	(0.15)	(0.16)
Same age (diff<5 years) +	0.25***	0.21	0.23**	0.25*
	(0.08)	(0.15)	(0.10)	(0.14)
Close family+	0.49***	0.39**	0.46***	0.47***
	(0.11)	(0.17)	(0.14)	(0.17)
Distant family+	0.40***	0.39	0.45***	0.56**
	(0.14)	(0.27)	(0.15)	(0.27)
Same iddir+	0.34***	-0.04	0.36***	0.08
	(0.11)	(0.23)	(0.14)	(0.19)
Same village+	0.04	0.59*	-0.21	0.44
	(0.20)	(0.30)	(0.29)	(0.28)
Same kebele+	-0.02	0.42	-0.19	0.32
	(0.27)	(0.36)	(0.36)	(0.33)
Farmer+	0.64***	0.94***	0.25*	0.94***
	(0.10)	(0.19)	(0.13)	(0.15)
Meet less than 1/week+	0.58***	0.67**	0.45**	0.66***
	(0.17)	(0.26)	(0.21)	(0.24)
Help when in need+	0.34	0.98**	0.03	1.19***
	(0.33)	(0.48)	(0.38)	(0.45)
Max of age from i & j	0.01*	-0.02**	0.01	-0.01*
	(0.00)	(0.01)	(0.01)	(0.01)
Education 1-4(dummy)	0.18	0.36	-0.06	0.48*
	(0.15)	(0.30)	(0.20)	(0.28)
Education 5-8(dummy)	0.10	-0.12	-0.16	-0.02
	(0.15)	(0.26)	(0.20)	(0.23)
Education 8+(dummy)	0.20	-0.23	0.15	-0.06
	(0.19)	(0.29)	(0.27)	(0.27)
Radio listening (frequency)	0.00	0.00	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Tv watching(frequency)	0.00	0.00	0.00*	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Travel to town(freq)	0.00**	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Size of own land (ha)(ln)	0.07**	0.15**	0.06	0.13**
	(0.04)	(0.06)	(0.05)	(0.06)
Hettosa-Tiyyo +	-0.24	0.05	-0.28	0.09
	(0.17)	(0.24)	(0.21)	(0.23)
Adaa-Lume+	-0.36**	0.20	-0.60***	0.16
	(0.15)	(0.21)	(0.19)	(0.20)
Constant	-2.29***	-2.16***	-0.93	-2.47***
	(0.47)	(0.81)	(0.65)	(0.74)
Observations	2565	1270	1295	1400
Log lik.	-1233.60	-362.57	-772.19	-436.31

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses (clustered at individual and household level). +Binary outcome. Other controls include same religion and same ethnicity (neither of which are statistically significant).

Table A3. 3. The effect of social network structure on the probability of adopting row-planting

(Dependent variable: 1 if i adopts row planting, 0 otherwise)

	(1) HH_HEADN1	(2) HH_HEADN2
Discussion on farming/business+	0.25**	0.22**
	(0.11)	(0.11)
Help when in need+	-0.18*	-0.16
	(0.10)	(0.10)
Related (blood/marriage) +	-0.06	-0.06
	(0.14)	(0.14)
Meeting frequency	-0.00	-0.00
	(0.00)	(0.00)
Geo.dist.(i,j)(ln)	-0.14**	-0.13**
	(0.06)	(0.06)
Having plots nearby	0.04	0.07
	(0.17)	(0.17)
Radio listening (frequency)	0.00	0.00
	(0.00)	(0.00)
Tv watching(frequency)	0.00***	0.00***
	(0.00)	(0.00)
Travel to town(freq)	-0.00***	-0.00***
	(0.00)	(0.00)
Diff. gender dummies	0.05	0.04
	(0.09)	(0.09)
Diff. of age (i,j)	-0.01*	-0.01
	(0.00)	(0.00)
Diff. educ (i,j)	0.00	0.00
	(0.01)	(0.01)
Diff. land size	0.18***	0.19***
	(0.03)	(0.03)
Diff. treatment status	0.14**	0.12*
	(0.06)	(0.07)
Sum gender dummies	-0.18*	-0.17*
	(0.09)	(0.09)
Sum of age (i,j)	-0.00	-0.00
	(0.00)	(0.00)
Sum of educ (i,j)	0.02	0.01
	(0.01)	(0.01)
Sum of land size	0.14***	0.15***
	(0.03)	(0.03)
Sum treatment status	0.22***	0.23***
	(0.07)	(0.07)
Dist. to MFI (minu~)		-0.00*
		(0.00)
Hettosa-Tiyyo	-2.36***	-2.26***
	(0.18)	(0.19)
Adaa-Lume	-2.95***	-2.71***
	(0.19)	(0.21)
Constant	1.79***	2.21***
	(0.45)	(0.44)
Other controls≠	No	Yes
Observations	1402	1402
Log lik.	-567.88	-557.93

Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. +Binary outcome

≠Note: the following controls were included but the coefficients were not statistically significant: same religion, same ethnicity, same iddir, sum and difference of men household members, and average distance in minutes to: asphalt road, market, district town, coop office, the nearest input dealer, farmer training center.

Table A3. 4. The effect of social learning on the adoption of row planting

(Dependent variable: 1 if i adopts row planting, 0 otherwise)

	(1) HH_Head1	(2) HH_Head2	(3) ALL1	(4) ALL2
Average value of peers' characteristics				
Change in Yield 2006-2010	0.00*	0.00	0.00***	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
Share of treated	0.67*	0.49	0.86*	0.40
	(0.40)	(0.41)	(0.47)	(0.52)
Household characteristics				
Education 5-8(dummy)	0.43	0.38	0.44*	0.44
	(0.27)	(0.27)	(0.27)	(0.27)
Tv watching(frequency)	0.00**	0.00**	0.00***	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
Size of own land (ha)(ln)	0.63***	0.69***	0.66***	0.71***
	(0.17)	(0.18)	(0.17)	(0.18)
Treated+	0.57***	0.51**	0.56***	0.52***
	(0.20)	(0.21)	(0.20)	(0.20)
Dist. market (minutes)(ln)		-0.33		-0.69*
		(0.26)		(0.39)
Dist. district town (minutes)(ln)		-0.16		3.83**
		(1.06)		(1.60)
Dist. MFI (minutes)(ln)		-0.88		-5.27***
		(1.06)		(1.68)
Hettosa-Tiyyo +	-2.43***	-2.32***	-2.03***	-1.80***
	(0.40)	(0.45)	(0.46)	(0.51)
Adaa-Lume+	-3.33***	-2.68***	-3.32***	-2.33***
	(0.39)	(0.53)	(0.44)	(0.65)
Constant	-1.23	5.34	-0.35	13.07**
	(2.87)	(3.92)	(3.46)	(5.46)
Other controls≠	Yes	Yes	Yes	Yes
Observations	346	346	348	348
Log lik.	-140.10	-135.29	-137.24	-129.51

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01. +Binary outcome

≠Note: the following controls were included but the coefficients were not statistically significant: networks' characteristics (average: age, household size, value of productive assets, value of consumer durables, livestock holdings, land holdings); own household characteristics (dummy for female household head, age and square of age of the household head, dummies for education of the household head (1st-4th) grade and 8+ grade, frequency of listening to a radio, dummy whether the household head engaged in business or wage labor, household size, distance in minutes to: asphalt road, coop office, the nearest input dealer, farmer training center).

Table A3. 5. The effect of social learning on the adoption of row-planting

(Dependent variable: 1 if i adopts row planting, 0 otherwise)

	(1) HH_Head3	(2) HH_Head4	(3) ALL3	(4) ALL4
Average value of peers' characteristics				
Change in ave. yield (2010-2014)	-0.00***	-0.00***	-0.00	-0.00*
	(0.00)	(0.00)	(0.00)	(0.00)
Share of treated	0.91**	0.68	0.89*	0.42
	(0.43)	(0.42)	(0.49)	(0.53)
Network size	0.32	0.27	0.03	0.03
	(0.38)	(0.39)	(0.17)	(0.17)
Network-size sq.	-0.02	-0.02	0.00	-0.00
	(0.05)	(0.05)	(0.01)	(0.01)
Household characteristics				
Education 5-8(dummy)	0.41	0.39	0.48*	0.47*
	(0.27)	(0.26)	(0.27)	(0.28)
Tv watching(frequency)	0.00**	0.00**	0.00**	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
Size of own land (ha)(ln)	0.63***	0.70***	0.61***	0.68***
	(0.18)	(0.19)	(0.17)	(0.19)
Treated+	0.59***	0.55***	0.54***	0.53***
	(0.20)	(0.21)	(0.20)	(0.20)
Dist. market (minutes)(ln)		-0.34		-0.66*
		(0.26)		(0.38)
Dist. district town (minutes)(ln)		-0.20		3.46**
		(1.07)		(1.58)
Dist. MFI (minutes)(ln)		-0.77		-5.01***
		(1.09)		(1.66)
Hettosa-Tiyyo +	-2.79***	-2.50***	-2.45***	-1.95***
	(0.41)	(0.47)	(0.44)	(0.50)
Adaa-Lume+	-3.52***	-2.88***	-3.32***	-2.35***
	(0.43)	(0.54)	(0.47)	(0.65)
Constant	-2.25	4.37	-2.39	11.41**
	(2.93)	(3.87)	(3.40)	(5.30)
Other controls≠	Yes	Yes	Yes	Yes
Observations	346	346	348	348
Log lik.	-138.10	-133.50	-139.20	-130.54

Standard errors (clustered at household and village level) in parentheses. * p<0.10, ** p<0.05, *** p<0.01. +Binary outcome

≠Note: the following controls were included but the coefficients were not statistically significant: networks' characteristics (average: age, household size, value of productive assets, value of consumer durables, livestock holdings, land holdings); own household characteristics (dummy for female household head, age and square of age of the household head, dummies for education of the household head (1st-4th) grade and 8+ grade, frequency of listening to a radio, dummy whether the household head engaged in business or wage labor, household size, distance in minutes to: asphalt road, coop office, the nearest input dealer, farmer training center).

Table A4. 1. Determinants of farmer innovativeness

(Dependent variable: Innovation index, count outcome)†

	(1) NEGBIN1	(3) NEGBIN2	(5) CONTFUN1	(6) NEGBIN3	(7) NEGBIN4	(8) NEGBIN5
Low aspirations+	-0.22***	-0.10	-0.24			
	(0.07)	(0.08)	(0.41)			
Narrow asp. gap+				0.35***	0.36***	
				(0.10)	(0.08)	
Large Asp-gap+				-0.01		-0.31***
				(0.13)		(0.11)
Female hh head+		-0.10	-0.10	-0.16	-0.16	-0.12
		(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Age of hh head		-0.00	0.00	-0.01	-0.01	-0.01
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Square of age		0.00	-0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education hh head		0.01	0.01	0.01	0.01	0.01
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HH size		-0.03*	-0.04**	-0.03*	-0.03*	-0.03*
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Total land holdings (ha)		0.02	0.02	0.03	0.03	0.03
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Past beneficiary+		0.04	0.03	0.04	0.04	0.06
		(0.07)	(0.06)	(0.06)	(0.06)	(0.07)
Negative shock+		-0.04	-0.01	-0.03	-0.03	-0.03
		(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Impatience		0.03	0.02	0.04**	0.04**	0.03*
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Risk aversion		0.00	0.00	0.01	0.01	0.01
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Credit use+		0.12*	0.13*	0.13*	0.13*	0.12*
		(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Value of assets(ln)		0.10**	0.08	0.11**	0.11**	0.11**
		(0.05)	(0.07)	(0.04)	(0.04)	(0.04)
Market (minutes)(ln)		0.05	0.05	0.07*	0.07*	0.06
		(0.04)	(0.05)	(0.04)	(0.04)	(0.04)
Coop office (minutes)(ln)		-0.09**	-0.09**	-0.08*	-0.08**	-0.08*
		(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Input dealer (minutes)(ln)		-0.06	-0.06	-0.04	-0.04	-0.05
		(0.04)	(0.04)	(0.03)	(0.03)	(0.04)
FTC (minutes) (ln)		0.02	0.02	0.02	0.02	0.01
		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Road (minutes)(ln)		-0.01	-0.01	-0.01	-0.01	-0.01
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Bakko-Sire+	-0.17	-0.15	-0.16	-0.08	-0.08	-0.13
	(0.19)	(0.19)	(0.20)	(0.19)	(0.19)	(0.19)
Hettosa-Tiyyo +	0.07	0.07	0.10	0.04	0.04	0.04
	(0.14)	(0.15)	(0.16)	(0.15)	(0.15)	(0.15)
Error			0.15			
			(0.42)			
Village dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.60***	0.78	0.94	0.32	0.31	0.61***
	(0.12)	(0.69)	(1.06)	(0.65)	(0.65)	(0.66)
lnalpha	-1.52***	-1.73***		-1.89***	-1.89***	-1.79***
	(0.19)	(0.22)		(0.25)	(0.25)	(0.23)
Observations	377	375	375	`375	375	375
Wald chi2	91.81	107.94	123.55	131.69	131.25	122.05
Log likelihood	-949.76	-930.32	-959.26	-920.23	-920.23	-926.38

Note: +Binary. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table A4. 2. The effect of narrow/large aspirations-gap on the use of improved seed, herbicides/pesticides, fertilizer, and row-planting techniques

(Dependent variables: dummies for use of: improved seed, row-planting, herbicides, and fertilizer)†
(Endogenous switching model with full information maximum likelihood)

	(1) i.seeds	(2) i.seeds	(3) Row-plant	(4) Row-plant	(5) Herbicides	(6) Herbicides	(7) Fertilizers	(8) Fertilizers
Narrow/large-gap	0.45	0.47	0.30	0.22	-0.21	-0.18	-0.88***	-0.75**
	(0.29)	(0.31)	(0.32)	(0.30)	(0.30)	(0.29)	(0.31)	(0.32)
Female hh head+	0.20	0.16	0.04	0.08	0.53***	0.49**	-0.03	-0.01
	(0.16)	(0.16)	(0.19)	(0.19)	(0.20)	(0.21)	(0.21)	(0.22)
Age hh head	-0.02	-0.02	0.01	0.01	-0.06**	-0.04	0.04	0.04
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Square of age	0.00	0.00	-0.00	-0.00	0.00*	0.00	-0.00	-0.00*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education of hh head	0.04***	0.04***	0.01	0.01	-0.01	-0.01	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
HH size	0.05**	0.05**	0.04*	0.04*	0.01	0.00	-0.05	-0.05
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Livestock holdings(TLU)	-0.01*	-0.01	-0.01	-0.01	0.00	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Value of assets (ln)	0.15***	0.13***	0.09*	0.08	0.12***	0.11**	0.12**	0.08
	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
Plot size (ha)	0.53***	0.55***	0.41***	0.39***	0.74***	0.76***	1.14***	1.21***
	(0.10)	(0.10)	(0.12)	(0.12)	(0.14)	(0.14)	(0.22)	(0.22)
Past beneficiary+	0.04	0.09	0.09	0.12	0.24**	0.27**	0.23*	0.24**
	(0.09)	(0.09)	(0.11)	(0.11)	(0.10)	(0.10)	(0.12)	(0.12)
Negative shock+	0.13	0.14*	0.13	0.17	0.06	0.08	0.12	0.09
	(0.08)	(0.09)	(0.10)	(0.10)	(0.10)	(0.10)	(0.11)	(0.12)
Impatience	0.03	0.03	0.02	0.02	0.09***	0.10***	0.02	0.03
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Risk aversion	-0.00	-0.01	0.01	0.01	0.02	0.01	-0.03	-0.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Low fertile+	0.05	0.07	-0.19	-0.18	-0.06	-0.03	0.29*	0.33*
	(0.13)	(0.13)	(0.16)	(0.17)	(0.15)	(0.15)	(0.17)	(0.18)
Med. fertile+	-0.06	-0.03	-0.17	-0.18*	-0.19*	-0.19*	0.16	0.16
	(0.09)	(0.09)	(0.10)	(0.11)	(0.11)	(0.11)	(0.12)	(0.12)
Dist.(<1 minute) +	-0.29	-0.25	0.25	0.25	-0.34	-0.43	-0.84	-0.96*
	(0.30)	(0.31)	(0.47)	(0.48)	(0.40)	(0.41)	(0.53)	(0.54)
Dist.(1-30 min) +	0.19	0.22	0.72	0.76*	-0.21	-0.29	-0.08	-0.13
	(0.27)	(0.28)	(0.45)	(0.46)	(0.38)	(0.38)	(0.51)	(0.52)
Dist.(31-60 min) +	0.17	0.20	0.69	0.74	-0.24	-0.26	0.03	-0.02
	(0.29)	(0.29)	(0.46)	(0.47)	(0.39)	(0.40)	(0.54)	(0.54)
Maize+	1.34***	1.34***	2.52***	2.57***	-2.26***	-2.29***	-0.53***	-0.54***
	(0.11)	(0.11)	(0.14)	(0.15)	(0.16)	(0.16)	(0.13)	(0.14)
Wheat+	0.37***	0.37***	0.63***	0.66***	-0.00	0.01	0.33*	0.34*
	(0.12)	(0.12)	(0.14)	(0.15)	(0.15)	(0.15)	(0.17)	(0.18)
Micro-financ (minutes)(ln)		-0.07		-0.07		-0.28***		-0.27**
		(0.07)		(0.08)		(0.09)		(0.11)
Market (minutes)(ln)		-0.01		0.04		0.07		-0.05
		(0.05)		(0.06)		(0.06)		(0.07)
Coop office (minutes)(ln)		-0.21***		0.01		-0.04		0.04
		(0.05)		(0.06)		(0.06)		(0.07)
Input dealer (minutes)(ln)		0.06		-0.14**		0.16***		0.03
		(0.05)		(0.06)		(0.06)		(0.07)
FTC (minutes)(ln)		0.23***		-0.13*		0.03		-0.08
		(0.06)		(0.07)		(0.07)		(0.08)
Road (minutes)(ln)		-0.00		-0.00		0.02		-0.00
		(0.02)		(0.03)		(0.02)		(0.03)
Bakko-Sire+	0.51***	0.48***	0.96***	0.86***	0.82***	0.76***	0.07	-0.15
	(0.13)	(0.16)	(0.16)	(0.18)	(0.17)	(0.19)	(0.16)	(0.20)
Hettosa-Tiyyo +	-0.35***	-0.36***	-0.00	-0.01	0.24*	0.27*	0.39**	0.30*
	(0.12)	(0.13)	(0.14)	(0.15)	(0.15)	(0.15)	(0.17)	(0.18)
_cons	-3.35***	-3.19***	-4.24***	-2.97***	1.33	1.63	0.06	1.57
	(0.69)	(0.83)	(0.93)	(1.07)	(0.83)	(1.00)	(0.95)	(1.14)

Table A4.2. continued

Switch part (dep var: Narrow/large-Asp.gap)								
Father's involvement in coop	-0.26***	-0.27***	-0.26***	-0.28***	-0.26***	-0.28***	-0.27***	-0.29***
	(0.05)	(0.06)	(0.05)	(0.06)	(0.06)	(0.06)	(0.05)	(0.06)
Female hh head+	0.48**	0.58**	0.51**	0.57**	0.46*	0.54**	0.44*	0.52**
	(0.24)	(0.24)	(0.25)	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)
Age hh head	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Square of age	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education of hh head	-0.01	0.01	-0.00	0.01	-0.01	0.01	-0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
HH size	-0.08***	-0.07***	-0.08***	-0.07***	-0.09***	-0.07***	-0.09***	-0.07***
	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)
Livestock holdings(TLU)	0.03***	0.04***	0.03**	0.04***	0.03**	0.04***	0.03**	0.04***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Value of assets (ln)	0.17***	0.13**	0.18***	0.13**	0.18***	0.13**	0.18***	0.13**
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Plot size (ha)	0.05	0.03	0.05	0.02	0.06	0.02	0.06	0.01
	(0.14)	(0.15)	(0.14)	(0.14)	(0.14)	(0.14)	(0.13)	(0.14)
Past beneficiary+	0.41***	0.31***	0.43***	0.33***	0.44***	0.33***	0.46***	0.34***
	(0.10)	(0.11)	(0.10)	(0.11)	(0.10)	(0.11)	(0.10)	(0.11)
Negative shock+	0.15	0.07	0.15	0.08	0.15	0.08	0.15	0.09
	(0.10)	(0.11)	(0.10)	(0.11)	(0.10)	(0.11)	(0.10)	(0.11)
Impatience	-0.04	-0.04	-0.03	-0.04	-0.04	-0.04	-0.03	-0.04
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Risk aversion	-0.09***	-0.08***	-0.10***	-0.08***	-0.10***	-0.08***	-0.10***	-0.08***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Low fertile+	-0.13	-0.19	-0.14	-0.20	-0.13	-0.19	-0.12	-0.17
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
Med. fertile+	0.13	0.05	0.12	0.04	0.12	0.04	0.13	0.06
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Dist.(<1 minute) +	0.55*	0.59*	0.60*	0.64**	0.61*	0.65**	0.59*	0.63*
	(0.32)	(0.32)	(0.32)	(0.33)	(0.32)	(0.33)	(0.32)	(0.32)
Dist.(1-30 min) +	0.50*	0.58**	0.55**	0.63**	0.56**	0.65**	0.54**	0.63**
	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)
Dist.(31-60 min) +	0.64**	0.75**	0.66**	0.78**	0.67**	0.79***	0.65**	0.75**
	(0.30)	(0.30)	(0.30)	(0.30)	(0.30)	(0.30)	(0.30)	(0.30)
Maize+	-0.23	-0.22	-0.22	-0.22	-0.20	-0.19	-0.16	-0.16
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.13)	(0.14)
Wheat+	0.12	0.10	0.12	0.10	0.12	0.11	0.13	0.11
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Micro-financ (minutes)(ln)		0.21**		0.21**		0.21**		0.21**
		(0.09)		(0.09)		(0.09)		(0.09)
Market (minutes)(ln)		0.01		0.03		0.03		0.02
		(0.07)		(0.07)		(0.07)		(0.07)
Coop office (minutes)(ln)		0.12		0.11		0.11		0.12*
		(0.07)		(0.07)		(0.07)		(0.07)
Input dealer (minutes)(ln)		-0.09		-0.11		-0.11		-0.11
		(0.07)		(0.07)		(0.07)		(0.07)
FTC (minutes)(ln)		-0.36***		-0.38***		-0.38***		-0.38***
		(0.08)		(0.08)		(0.08)		(0.08)
Road (minutes)(ln)		-0.12***		-0.11***		-0.11***		-0.10***
		(0.04)		(0.04)		(0.04)		(0.04)
Bakko-Sire+	0.59***	0.75***	0.57***	0.72***	0.56***	0.70***	0.53***	0.66***
	(0.16)	(0.18)	(0.16)	(0.18)	(0.16)	(0.18)	(0.15)	(0.18)
Hettosa-Tiyyo +	0.49***	0.53***	0.53***	0.56***	0.52***	0.55***	0.54***	0.57***
	(0.15)	(0.16)	(0.14)	(0.16)	(0.15)	(0.16)	(0.15)	(0.16)
_cons	0.37	0.90	0.22	0.82	0.20	0.77	0.28	0.82
	(0.91)	(1.09)	(0.90)	(1.10)	(0.91)	(1.10)	(0.90)	(1.10)
rho	-0.39**	-0.37**	-0.26	-0.24	-0.01**	0.02	0.49**	0.42**
	(0.17)	(0.18)	(0.19)	(0.17)	(0.17)	(0.17)	(0.19)	(0.19)
Wald chi2	559***	596***	708***	734***	618***	656***	343***	375***
Observations	1595	1595	1595	1595	1595	1595	1595	1595

Note: +Binary. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table A4. 3. Determinants of the intensity of fertilizer use (by crop type)

(Endogenous treatment-effects model with maximum likelihood)†

	(1) Teff1	(2) Teff2	(3) Maize1	(4) Maize2	(5) Wheat1	(6) Wheat2
	OLS	Endog.Te.	OLS	Endog.Te.	OLS	Endog.Te.
Narrow/large asp.gap+	-3.03	-67.32**	8.42	14.52	8.22	-13.07
	(9.28)	(30.25)	(10.02)	(36.65)	(14.56)	(20.22)
Female hh head+	-23.06*	-0.39	-6.22	2.23	15.90	16.27
	(13.36)	(16.76)	(11.66)	(13.00)	(14.83)	(15.76)
Age of hh head	-2.52	-0.48	0.08	0.09	-0.21	-0.05
	(1.97)	(0.06)	(1.61)	(1.60)	(2.19)	(2.11)
Square of age	0.02	-0.00	-0.00	0.00	0.00	0.00
	(0.02)	(0.00)	(0.01)	(0.01)	(0.02)	(0.02)
Education hh head	0.64	0.37	0.82	0.02	1.65	1.87
	(1.13)	(0.03)	(1.31)	(1.33)	(1.21)	(1.22)
HH size	1.76	-0.08	0.10	0.03	0.48	0.49
	(2.09)	(0.06)	(1.62)	(1.69)	(1.92)	(1.94)
Livestock(TLU)	-0.81	-1.03	1.53	1.61	1.62	1.89**
	(0.88)	(0.84)	(0.97)	(0.99)	(1.00)	(0.96)
Value of assets(ln)	8.63**	9.18**	11.16**	11.39**	1.43	1.45
	(3.41)	(3.75)	(5.03)	(0.11)	(3.64)	(3.37)
Past beneficiary+	1.08	0.38*	5.94	5.44	3.05	2.65
	(7.91)	(8.93)	(7.35)	(7.66)	(8.90)	(9.13)
Negative shock+	-3.19	0.28	1.02	3.30	-13.51*	-8.22
	(7.32)	(8.53)	(6.92)	(0.26)	(7.90)	(7.71)
Impatience	0.00	-1.18	1.04	-0.03	-2.06	-2.69
	(1.91)	(0.06)	(2.22)	(0.07)	(2.13)	(2.11)
Risk aversion	1.20	-0.90	1.29	-0.03	1.15	1.25
	(1.48)	(0.04)	(1.33)	(1.45)	(1.49)	(1.52)
Land size with Teff (ha)	-2.88	-4.26				
	(4.70)	(5.73)				
Land size with Maize (ha)			-11.23***	-11.17***		
			(3.69)	(3.57)		
Land size with Wheat (ha)					-0.98	-0.69
					(2.87)	(2.89)
Micro-financ (minutes)(ln)	13.85**	0.04	-1.79	0.32	7.85	8.75
	(5.61)	(0.18)	(5.11)	(0.22)	(7.50)	(7.58)
Market (minutes)(ln)	3.17	0.11	-1.09	-1.86	-5.44	-6.72
	(4.22)	(0.14)	(3.86)	(4.11)	(4.82)	(4.63)
Coop office (minutes)(ln)	2.04	0.19	-4.48	-4.45	0.65	-2.30
	(4.36)	(4.99)	(4.33)	(0.16)	(4.25)	(3.92)
Input dealer (minutes)(ln)	-11.46**	-0.08	-4.33	-5.37	2.35	2.15
	(5.35)	(0.15)	(5.66)	(0.16)	(5.30)	(5.27)
FTC (minutes) (ln)	-2.34	-0.39**	13.00***	13.59**	3.30	5.48
	(4.76)	(6.20)	(4.86)	(0.17)	(5.29)	(5.15)
Road (minutes)(ln)	3.09	2.77	0.35	-0.13**	-2.62	-3.23
	(1.90)	(1.83)	(1.74)	(0.06)	(2.13)	(2.09)
Bakko-Sire+	-106.24***	0.10	231.50***	0.10	-117.09***	-110.84***
	(11.56)	(12.46)	(12.67)	(13.17)	(24.39)	(25.42)
Hettosa-Tiyyo +	-74.76***	-68.69***	45.44***	0.42	-52.91***	-50.64***
	(15.21)	(0.53)	(10.71)	(0.34)	(10.76)	(10.30)
Constant	108.66*	140.94**	-107.02*	-107.51*	113.62	121.71*
	(63.33)	(67.83)	(63.54)	(61.67)	(73.78)	(73.30)
Switch part (dep var: Narrow/large-Asp.gap)						
Mother's involvement in *Kebele*		0.46***				0.44**
		(0.13)				(0.23)
Father's involvement in Coop				-0.38***		
				(0.14)		
Female hh head+		-17.95		0.59		0.17
		(0.42)		(0.58)		(0.51)
Age of hh head		0.01		-0.03		-0.10
		(1.93)		(0.06)		(0.08)
Square of age		0.00		0.00		0.00
		(0.02)		(0.00)		(0.00)

Table A4.3 continued						
Education hh head		-0.01		0.50		-0.01
		(1.20)		(0.04)		(0.04)
HH size		0.45		-0.24		-0.18***
		(2.47)		(0.06)		(0.07)
Livestock(TLU)		0.00		-0.00		0.01
		(0.02)		(0.03)		(0.03)
Value of assets(ln)		0.13		0.13		0.13
		(0.10)		(5.39)		(0.11)
Past beneficiary+		8.38		0.12		0.48*
		(0.23)		(0.27)		(0.29)
Negative shock+		4.39		0.20		-0.10
		(0.24)		(7.42)		(0.28)
Impatience		-0.04		0.90		0.03
		(2.11)		(2.33)		(0.08)
Risk aversion		-0.09**		1.17		-0.05
		(1.83)		(0.05)		(0.06)
Land size with Teff (ha)		-0.05				
		(0.15)				
Land size with Maize (ha)				0.37		
				(0.26)		
Land size with Wheat (ha)						0.28
						(0.21)
Micro-finance (minutes) (ln)		13.59**		-1.79		0.36*
		(5.89)		(5.79)		(0.20)
Market (minutes)(ln)		4.86		0.03		0.03
		(4.96)		(0.17)		(0.16)
Coop office (minutes)(ln)		4.74		0.01		0.03
		(0.17)		(4.42)		(0.13)
Input dealer (minutes)(ln)		-13.24**		-0.23		-0.17
		(5.71)		(6.08)		(0.16)
FTC (minutes) (ln)		-8.80		-0.16		-0.48***
		(0.18)		(5.47)		(0.17)
Road (minutes)(ln)		-0.08		0.61		-0.25
		(0.06)		(1.78)		(0.16)
Bakko-Sire+		-102.30***		228.97***		6.50***
		(0.45)		(0.45)		(0.67)
Hettosa-Tiyyo +		0.20		45.26***		0.05
		(17.79)		(11.43)		(0.43)
Constant		0.39		0.58		3.32
		(1.88)		(2.06)		(2.42)
athrho (Constant)		0.86**		-0.05		0.30**
		(0.44)		(0.34)		(0.15)
lnsigma (Constant)		3.99***		3.93***		3.92***
		(0.11)		(0.09)		(0.06)
Wald chi2		260.66		1762.43		102.46
Log lik.	-1165.9	-1140.42	-1308.63	-1275.79	-1203.38	-1167.53
r2	0.53		0.8		0.3	
Observations	220	200	246	223	225	208

Note: +Binary. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table A4. 4. Determinants of intensity of fertilizer use, household level

(Endogenous treatment-effects model with maximum likelihood, Endog.Te.)†

	(1) Intensity	(2) Intensity	(3) Intensity	(4) Intensity
	OLS	Endog.Te.	Endog.Te.	Endog.Te.
Narrow/large asp.gap+	8.11	-104.79***	-105.35***	-106.43***
	(10.81)	(23.86)	(22.09)	(22.26)
Female hh head+	-6.59	2.44	2.49	2.57
	(12.58)	(0.31)	(12.78)	(12.80)
Age of hh head	2.74	3.06	3.06	3.06
	(2.06)	(2.30)	(2.30)	(0.04)
Square of age	-0.02	-0.02	-0.02	-0.02
	(0.02)	(0.02)	(0.02)	(0.00)
Education of hh head	1.55	1.45	1.45	1.44
	(1.26)	(1.42)	(1.42)	(0.03)
HH size	-1.23	-2.65	-2.65	-2.67
	(2.09)	(2.29)	(2.29)	(0.04)
Total land holdings (ha)	-9.76***	-9.33***	-9.33***	0.00
	(2.83)	(3.14)	(3.15)	(3.15)
Livestock holdings (TLU)	3.71***	3.93***	3.94***	3.94***
	(1.17)	(1.22)	(1.22)	(0.02)
Value of assets(ln)	12.70***	0.15*	16.61***	0.15*
	(3.68)	(0.08)	(4.18)	(4.19)
Past beneficiary+	4.18	0.34*	12.37	0.38**
	(8.01)	(9.65)	(9.59)	(0.17)
Negative shock+	0.82	0.20	5.13	5.17
	(8.51)	(10.08)	(10.07)	(10.09)
Impatience	-2.12	-0.11**	-3.27	-0.11**
	(2.29)	(0.05)	(2.57)	(2.58)
Risk aversion	0.06	-1.16	-1.17	-0.07**
	(1.49)	(0.03)	(1.78)	(1.79)
Micro-finance (minutes)(ln)	-2.45	0.04	0.83	0.02
	(7.48)	(7.89)	(7.92)	(7.93)
Market (minutes)(ln)	-1.75	-1.85	-1.85	0.06
	(4.43)	(4.93)	(4.93)	(4.94)
Coop office (minutes)(ln)	4.59	7.32	7.34	0.06
	(4.17)	(4.69)	(4.69)	(0.11)
Input dealer (minutes)(ln)	1.00	-2.04	-2.05	-2.08
	(4.39)	(0.11)	(4.81)	(0.11)
FTC (minutes) (ln)	1.65	-0.10	-2.34	-0.12
	(4.84)	(0.11)	(5.50)	(5.52)
Road (minutes)(ln)	-0.11	-2.06	-2.07	-0.14**
	(1.67)	(1.66)	(1.66)	(1.66)
Bakko-Sire+	80.21***	0.45*	87.90***	0.48*
	(13.30)	(0.26)	(14.42)	(0.26)
Hitossa-Tiyo+	-36.60***	0.26	-26.22***	-26.12***
	(7.82)	(0.23)	(9.68)	(0.22)
Constant	-38.48	20.13	20.42	20.98
	(72.99)	(77.54)	(77.56)	(77.72)
Father's involvement in coop		-0.12	-0.15*	-0.16*
		(0.09)	(0.08)	(0.09)
Father's involvement in religious group			0.38**	0.37**
			(0.16)	(0.16)
Ratio of inc. growth(2006/2010)		-0.00	-0.00	
		(0.00)	(0.00)	
Female hh head+		0.49	0.53*	0.54*
		(12.74)	(0.32)	(0.32)
Age of hh head		0.05	0.05	0.05
		(0.04)	(0.04)	(2.30)
Square of age		-0.00	-0.00	-0.00
		(0.00)	(0.00)	(0.02)
Education hh head		0.02	0.01	0.01
		(0.03)	(0.03)	(1.42)
HH size		-0.04	-0.05	-0.05

Table A4.4. continued

		(0.04)	(0.04)	(2.30)
Total land holdings (ha)		0.00	-0.00	-9.33***
		(0.06)	(0.06)	(0.06)
Livestock holdings (TLU)		0.01	0.01	0.01
		(0.02)	(0.02)	(1.22)
Value of assets(ln)		16.59***	0.15*	16.65***
		(4.17)	(0.08)	(0.08)
Past beneficiary+		12.33	0.37**	12.45
		(0.18)	(0.17)	(9.62)
Negative shock+		5.11	0.19	0.19
		(0.19)	(0.19)	(0.19)
Impatience		-3.26	-0.11**	-3.28
		(2.57)	(0.05)	(0.05)
Risk aversion		-0.05	-0.07**	-1.18
		(1.79)	(0.03)	(0.03)
Micro-finance (minutes)(ln)		0.81	0.02	0.86
		(0.15)	(0.15)	(0.15)
Market (minutes)(ln)		0.06	0.06	-1.85
		(0.10)	(0.10)	(0.10)
Coop office (minutes)(ln)		0.06	0.06	7.36
		(0.11)	(0.11)	(4.70)
Input dealer (minutes)(ln)		-0.08	-0.08	-0.08
		(4.81)	(0.11)	(4.81)
FTC (minutes)(ln)		-2.32	-0.12	-2.38
		(5.52)	(0.10)	(0.10)
Road (minutes)(ln)		-0.16**	-0.13**	-2.09
		(0.07)	(0.06)	(0.06)
Bakko-Sire+		87.86***	0.46*	87.98***
		(14.44)	(0.27)	(14.45)
Hitossa-Tiyo+		-26.27***	0.25	0.27
		(9.69)	(0.23)	(9.71)
Constatnt		-1.06	-1.11	-1.09
		(1.49)	(1.48)	(1.48)
athrho (constant)		1.21***	1.24***	1.25***
		(0.28)	(0.27)	(0.27)
lnsigma (constatnt)		4.35***	4.36***	4.36***
		(0.11)	(0.11)	(0.11)
Observations	352	352	352	352
Wald chi2		185.03	187.64	186.92
Log lik.	-1983.62	-2102.51	-2100.63	-2100.91
r2	0.38			

Note: +Binary. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Table A4. 5. Correlation of aspirations and psychosocial indicators

(Dependent variable: Aspirations index)†

	(1) SE	(2) LC	(3) OC	(4) E	(5) T	(6) SW	(7) PP	(8) ALL
Self-esteem	0.17**							0.12
	(0.08)							(0.09)
Locus of control		0.07						-0.10
		(0.11)						(0.12)
Openness to change			0.08					0.06
			(0.06)					(0.07)
Envy				-0.00				-0.01
				(0.03)				(0.03)
Trust					0.09***			0.09***
					(0.03)			(0.03)
Subjective well-being						0.08***		0.09***
						(0.03)		(0.03)
Poverty caused by external factors							-0.13	-0.12
							(0.10)	(0.09)
Female hh head+	0.03	0.02	0.02	0.01	0.06	0.01	0.01	0.06
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Age of hh head	-0.00	0.00	-0.00	-0.00	-0.01	0.00	-0.00	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Square of age	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education hh head	0.03***	0.03***	0.03***	0.03***	0.03***	0.03***	0.03***	0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HH size	0.03**	0.03**	0.03**	0.03**	0.03***	0.03*	0.03**	0.03**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Total land holdings (ha)	0.07***	0.07***	0.07***	0.08***	0.08***	0.08***	0.07***	0.07***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Livestock holdings (TLU)	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Value of assets(ln)	0.07**	0.07**	0.08***	0.07***	0.08***	0.06**	0.07***	0.07**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Negative shock+	-0.06	-0.07	-0.07	-0.07	-0.05	-0.06	-0.08	-0.05
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Mean of others' asset holdings (ln)	-2.49	-2.75	-3.26	-3.14	-2.57	-2.90	-2.62	-2.10
	(4.87)	(4.52)	(4.70)	(4.67)	(4.44)	(4.61)	(4.72)	(5.00)
Mean of others' income growth (2010-2014)	0.59	0.77	0.82	0.74	0.49	1.00	0.94	0.92
	(0.90)	(0.94)	(0.95)	(0.94)	(0.91)	(0.93)	(0.96)	(0.94)
Village dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	39.67	43.88	52.31	50.28	40.98	46.59	41.87	33.65
	(79.03)	(73.41)	(76.34)	(75.79)	(72.01)	(74.76)	(76.56)	(81.09)
Observations	375	375	375	375	375	375	375	375
R-squared	0.31	0.29	0.30	0.29	0.31	0.30	0.30	0.33

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. +Binary.

Table A4. 6. Correlation of expectations and psychosocial indicators

(Dependent variable: Expectations index)

	(1) SE	(2) LC	(3) OC	(4) E	(5) T	(6) SW	(7) PP	(8) ALL
Self-esteem	0.22***							0.11
	(0.07)							(0.09)
Locus of control		0.26***						0.20**
		(0.08)						(0.10)
Openness to change			-0.05					-0.09
			(0.05)					(0.06)
Envy				-0.03				-0.01
				(0.03)				(0.03)
Trust					0.12***			0.10**
					(0.04)			(0.04)
Subjective well-being						0.08**		0.10***
						(0.04)		(0.04)
Perception on causes of poverty as external							-0.17**	0.01
							(0.07)	(0.09)
Female hh head+	0.00	0.01	-0.01	-0.01	0.06	-0.01	-0.01	0.06
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.09)	(0.10)	(0.10)
Age of hh head	-0.00	0.00	0.00	0.00	-0.01	0.00	-0.00	0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Square of age	0.00	-0.00	-0.00	-0.00	0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Education hh head	0.04***	0.04***	0.04***	0.04***	0.04***	0.04***	0.04***	0.04***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
HH size	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Total land holdings (ha)	0.12***	0.11***	0.12***	0.12***	0.12***	0.12***	0.11***	0.11***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Livestock holdings (TLU)	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Value of assets (ln)	0.03	0.03	0.04	0.03	0.05	0.02	0.04	0.02
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Negative shock+	-0.10*	-0.12*	-0.11*	-0.11*	-0.09	-0.10*	-0.13**	-0.08
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Mean of others' asset holdings (ln)	-6.54	-5.88	-7.29	-7.76	-6.61	-7.12	-6.71	-4.88
	(9.99)	(9.44)	(9.52)	(9.46)	(9.24)	(9.59)	(9.79)	(9.30)
Mean of others' income growth (2010-2014)	-2.94*	-2.64*	-2.80*	-2.61*	-3.09**	-2.48	-2.51	-2.75*
Village dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	104.28	93.62	116.37	124.11	105.40	113.91	107.24	77.46
	(162.02)	(153.16)	(154.39)	(153.45)	(149.92)	(155.50)	(158.75)	(150.86)
Observations	375	375	375	375	375	375	375	375
R-squared	0.38	0.39	0.36	0.36	0.38	0.37	0.37	0.42

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. +Binary.

Table A5. 1. Correlates of annual income per capita (in log.) and monthly household consumption expenditure per capita (in log.)

	(1) INC_pc1	(2) INC_pc2	(3) EXP_pc1	(4) EXP_pc2	(5) INC_pc3	(6) # EXP_pc3
Aspirations Head	0.14***	0.15***	0.13***	0.15***	0.13**	0.13***
	(0.05)	(0.04)	(0.04)	(0.04)	(0.06)	(0.04)
Aspirations Spouse	0.05	0.05	-0.05	-0.07*		
	(0.06)	(0.05)	(0.04)	(0.04)		
Aspirations(Head*Spouse)	0.02		-0.04			
	(0.06)		(0.04)			
Aspirat.*INChange(2006-10)	-0.00					
	(0.00)					
Aspirat.*ChangeExpen(2006-10)			-0.00			
			(0.00)			
Female hh head+					-0.49**	0.03
					(0.19)	(0.07)
HH head Age31-50+	-0.14	-0.17	-0.01	-0.02	-0.15	0.17
	(0.16)	(0.15)	(0.13)	(0.13)	(0.13)	(0.12)
HH head Age above51+	-0.08	-0.11	-0.07	-0.06	-0.14	0.11
	(0.17)	(0.16)	(0.13)	(0.13)	(0.14)	(0.13)
Spouse Age31-50+	-0.03	-0.02	0.09	0.10		
	(0.11)	(0.11)	(0.08)	(0.08)		
Spouse Age above51+	0.06	0.07	0.19**	0.19**		
	(0.13)	(0.13)	(0.09)	(0.09)		
Head education: 0-4+	0.26***	0.27***	-0.06	-0.04	0.19**	-0.02
	(0.08)	(0.08)	(0.07)	(0.07)	(0.08)	(0.06)
Head education: 5-8+	0.15*	0.15*	0.01	0.02	0.07	0.01
	(0.08)	(0.08)	(0.07)	(0.07)	(0.09)	(0.06)
Head education: above 8+	0.13	0.14	0.05	0.05	0.11	0.07
	(0.10)	(0.09)	(0.08)	(0.08)	(0.09)	(0.07)
Spouse education: 0-4+	-0.01	-0.02	0.03	0.04		
	(0.08)	(0.08)	(0.07)	(0.07)		
Spouse education: 5-8+	0.09	0.10	-0.04	-0.04		
	(0.09)	(0.09)	(0.07)	(0.07)		
Spouse education: above 8+	0.15	0.17	0.13	0.14		
	(0.14)	(0.14)	(0.09)	(0.09)		
HH size(ln)	-0.84***	-0.86***	-0.54***	-0.52***	-0.67***	-0.48***
	(0.11)	(0.11)	(0.08)	(0.08)	(0.21)	(0.07)
Dependency ratio	0.00	0.02	-0.14	-0.16	-0.19	-0.12
	(0.20)	(0.19)	(0.14)	(0.14)	(0.29)	(0.12)
Off-farm income+	0.06	0.06	0.00	0.00	0.07	-0.06
	(0.07)	(0.06)	(0.05)	(0.05)	(0.07)	(0.05)
Change in Income (2006-10)	-0.00				-0.00	
	(0.00)				(0.00)	
Value of assets	0.09***	0.09***	0.07***	0.07***	0.13***	0.08***
	(0.03)	(0.03)	(0.03)	(0.02)	(0.05)	(0.03)
Change in PC Expenditure (2006-10)			0.00			0.00
			(0.00)			(0.00)
Livestock holding(TLU)	0.03***	0.03***	0.02**	0.02***	0.04***	0.02**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Land in ha(ln)	0.45***	0.46***	0.08	0.07	0.44***	0.09*
	(0.11)	(0.11)	(0.06)	(0.06)	(0.13)	(0.05)
Too much rain or flood+	0.16	0.17*	0.16	0.16	0.19*	0.15*
	(0.10)	(0.10)	(0.11)	(0.11)	(0.10)	(0.08)
Micro-finance. (minutes) (ln)	-0.10*	-0.10*	0.03	0.03	-0.10*	0.03
	(0.05)	(0.05)	(0.04)	(0.04)	(0.06)	(0.03)
Bakko-Sire+	-0.13	-0.15	-0.16**	-0.15**	-0.05	-0.14**
	(0.10)	(0.10)	(0.07)	(0.07)	(0.12)	(0.06)
Hettosa-Tiyyo+	0.40***	0.41***	0.19***	0.20***	0.61***	0.20***
	(0.07)	(0.07)	(0.06)	(0.06)	(0.13)	(0.05)
Constant	7.98***	8.02***	6.23***	6.14***	7.09***	6.02***
	(0.47)	(0.48)	(0.30)	(0.30)	(0.74)	(0.28)
Observations	304	304	301	304	375	372
R-squared	0.62	0.62	0.41	0.41	0.52	0.37

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. #Note: the following indicators were controlled but the coefficients were not statistically significant: distance to- market, and asphalt road; dummies for experience of shocks including livestock diseases, death/loss of livestock, increased input prices, illness of household head/spouse, and illness of other family member. +Binary. Note: Female-headed households drop out from the analysis (column 1-4) when we consider the characteristics of both the household head and the spouse. This is true for tables A5.1 and A5.2.

Table A5. 2. Correlation of aspirations and other factors with food (in)security

	(1) pc_Calorie	(2) FCS	(3) HDDS	(4) HFIAS	(5) pc_Calorie_H	(6) FCS_H	(7) HDDS_H	(8) HFIAS_H
Aspirations Head	422.38***	4.50**	0.36**	-0.34**	364.38***	2.82	0.28**	-0.35**
	(129.72)	(1.81)	(0.15)	(0.16)	(123.54)	(1.98)	(0.13)	(0.16)
Aspirations Spouse	-183.02	-0.88	-0.07	-0.00				
	(122.89)	(1.76)	(0.13)	(0.29)				
Aspirations(Head*Spouse)	-82.35	-4.96***	-0.12	0.18				
	(92.69)	(1.52)	(0.13)	(0.19)				
Aspirat.*INChange(2006-10)	0.00	0.00	0.00	-0.00	-0.00	0.00	0.00	-0.00
	(0.06)	(0.00)	(0.00)	(0.00)	(0.05)	(0.00)	(0.00)	(0.00)
Female hh head+					6.39	-6.08*	-0.57**	0.09
					(254.72)	(3.35)	(0.24)	(0.33)
HH head Age31-50+	-170.90	-2.87	-0.49	-0.59	65.69	-1.15	-0.28	-0.19
	(306.19)	(5.72)	(0.38)	(0.76)	(245.55)	(4.18)	(0.30)	(0.58)
HH head Age above51+	-267.57	-4.38	-0.62	-0.76	-48.14	-2.25	-0.48	-0.46
	(337.34)	(6.05)	(0.40)	(0.69)	(258.40)	(4.24)	(0.32)	(0.52)
Spouse Age31-50+	103.65	1.93	0.10	0.14				
	(205.33)	(2.97)	(0.24)	(0.26)				
Spouse Age above51+	-92.47	3.67	0.46	-0.33				
	(272.30)	(3.76)	(0.32)	(0.34)				
Head education: 0-4+	-106.28	-5.99**	-0.51**	-0.16	107.32	-4.92*	-0.46**	0.10
	(209.68)	(2.97)	(0.22)	(0.48)	(191.58)	(2.67)	(0.20)	(0.34)
Head education: 5-8+	-113.99	0.16	-0.09	-0.70*	70.13	0.45	-0.13	-0.35
	(199.53)	(2.64)	(0.21)	(0.42)	(184.86)	(2.42)	(0.19)	(0.28)
Head education: above 8+	13.05	0.82	-0.24	-0.60	3.21	0.58	-0.24	-0.15
	(237.26)	(3.28)	(0.24)	(0.41)	(256.19)	(2.83)	(0.21)	(0.38)
Spouse education: 0-4+	199.23	2.64	0.10	0.46				
	(167.94)	(2.59)	(0.20)	(0.46)				
Spouse education: 5-8+	-274.66	1.36	0.21	0.42				
	(201.28)	(2.99)	(0.22)	(0.38)				
Spouse education: above 8+	154.56	8.61**	0.62**	0.37				
	(308.88)	(4.15)	(0.31)	(0.34)				
HH size(ln)	-991.32***	5.78*	0.78***	0.68	-1,372.61***	6.49**	0.74***	0.40
	(256.25)	(3.25)	(0.28)	(0.49)	(258.99)	(2.67)	(0.23)	(0.34)
HH head in business/wage+	-334.85**	-2.95	0.02	-0.12				
	(152.56)	(2.32)	(0.16)	(0.28)				
Spouse in business/wage+	159.60	2.41	0.31*	0.32				
	(171.65)	(2.24)	(0.17)	(0.38)				
Change in Incom (2006-10)	0.00	0.00	-0.00	-0.00*	0.01	0.00	-0.00	-0.00
	(0.06)	(0.00)	(0.00)	(0.00)	(0.05)	(0.00)	(0.00)	(0.00)
Income per-adult equiv. (ln)	0.05	0.00***	0.00***	-0.00	0.03	0.00***	0.00***	-0.00
	(0.04)	(0.00)	(0.00)	(0.00)	(0.04)	(0.00)	(0.00)	(0.00)
Value of assets (ln)	-77.23	0.07	0.15*	-0.20	-30.53	0.77	0.19***	-0.21*
	(71.11)	(1.00)	(0.08)	(0.13)	(66.91)	(0.87)	(0.07)	(0.13)
Livestock holding(TLU)	58.02***	0.50**	0.01	0.00	47.09***	0.30	-0.00	0.01
	(17.00)	(0.23)	(0.02)	(0.02)	(16.51)	(0.22)	(0.02)	(0.02)
Too much rain or flood+	594.27*	6.63**	0.38	0.08	493.57*	5.58*	0.49**	0.12
	(356.11)	(3.18)	(0.25)	(0.88)	(275.17)	(2.89)	(0.20)	(0.67)
Increased input prices	-79.46	-2.35	-0.14	1.22**	96.41	-2.89	-0.06	0.70
	(224.08)	(3.36)	(0.21)	(0.59)	(211.23)	(3.09)	(0.20)	(0.52)
Illness of other family	484.20**	4.60	0.47**	0.33	294.93	4.61	0.35*	0.39
	(237.91)	(3.21)	(0.22)	(0.64)	(214.57)	(2.90)	(0.20)	(0.58)
Road (minutes)(ln)	-80.96**	0.10	-0.01	0.06	-42.34	0.29	0.01	0.04
	(39.38)	(0.42)	(0.03)	(0.04)	(38.46)	(0.45)	(0.03)	(0.04)
Market(minutes)(ln)	-53.17	-2.85***	-0.28***	-0.05	-71.33	-2.66***	-0.25***	-0.04
	(81.56)	(1.06)	(0.08)	(0.12)	(82.39)	(0.97)	(0.07)	(0.10)
Micro-finance (minutes)(ln)	63.99	2.47*	0.12	-0.13	159.08	2.09	0.09	-0.28*
	(111.41)	(1.43)	(0.12)	(0.14)	(101.01)	(1.31)	(0.10)	(0.14)
Health center(minutes)(ln)	166.19	3.34***	0.15	-0.11	68.41	2.67**	0.09	-0.10
	(103.22)	(1.23)	(0.10)	(0.09)	(89.27)	(1.10)	(0.09)	(0.10)
District dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4,286.7***	37.71***	6.01***	2.42	4,343.51***	32.54***	5.97***	3.49**
	(928.07)	(14.15)	(1.05)	(1.76)	(948.31)	(11.76)	(0.88)	(1.62)
Observations	302	302	302	302	374	374	374	375
R-squared	0.35	0.31	0.31	0.23	0.32	0.29	0.30	0.16

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. #Note: the following indicators were controlled but the coefficients were not statistically significant: size of land holdings, dependency ratio, access to off-farm income, distance to- market, and asphalt road; dummies for experience of shocks including livestock diseases, illness of household head/spouse, and death/loss of livestock. +Binary.

Table A5. 3. Correlation of aspirations and other factors with wives' life satisfaction and/or happiness

	(1) BestA1	(2) BestA2	(3) HappyA1	(4) HappyA2	(5) BestE1	(6) BestE2	(7) HappyE1	(8) HappyE2
Aspirations Spouse	-0.32*	-0.16	0.16	0.16				
	(0.19)	(0.21)	(0.23)	(0.22)				
Expectations Spouse					-0.15	0.03	0.16	0.17
					(0.22)	(0.22)	(0.24)	(0.21)
Spouse Age31-50+	-0.05	-0.05	0.35	0.31	-0.11	-0.08	0.37	0.33
	(0.32)	(0.33)	(0.31)	(0.30)	(0.32)	(0.33)	(0.31)	(0.30)
Spouse Age above51+	-0.47	-0.54	0.26	0.31	-0.58	-0.58	0.33	0.38
	(0.39)	(0.39)	(0.37)	(0.35)	(0.38)	(0.38)	(0.38)	(0.36)
Spouse education: 0-4+	0.09	0.17	0.08	-0.07	0.08	0.18	0.09	-0.06
	(0.27)	(0.27)	(0.29)	(0.28)	(0.28)	(0.28)	(0.29)	(0.28)
Spouse education: 5-8+	0.09	0.18	0.38	0.20	0.13	0.19	0.35	0.17
	(0.31)	(0.33)	(0.32)	(0.33)	(0.32)	(0.33)	(0.32)	(0.32)
Spouse education: above 8+	0.33	0.49	0.13	-0.01	0.30	0.45	0.11	-0.05
	(0.36)	(0.35)	(0.38)	(0.41)	(0.35)	(0.35)	(0.39)	(0.41)
HH size(ln)	0.71*	0.48	0.48	0.06	0.69*	0.45	0.47	0.04
	(0.41)	(0.42)	(0.42)	(0.43)	(0.41)	(0.42)	(0.42)	(0.43)
Spouse in business/wage+	-0.90***	-0.85***	-1.06***	-0.94***	-0.90***	-0.86***	-1.07***	-0.95***
	(0.24)	(0.25)	(0.26)	(0.26)	(0.24)	(0.26)	(0.26)	(0.26)
Change in Incom (2006-10)	-0.00	-0.00	0.00	0.00	-0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Income per-adult equiv.(ln)	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Expenditue quintile	0.18**	0.20**	0.09	0.12	0.19**	0.20**	0.09	0.12
	(0.09)	(0.08)	(0.09)	(0.09)	(0.09)	(0.08)	(0.09)	(0.09)
Wealth quintile	0.17	0.16	0.01	0.03	0.21	0.17	-0.01	0.02
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
Value of assets (ln)	-0.08	-0.12	0.11	0.03	-0.11	-0.13	0.12	0.04
	(0.13)	(0.12)	(0.13)	(0.12)	(0.13)	(0.12)	(0.13)	(0.12)
Livestock holding(TLU)	0.05	0.06*	0.02	0.02	0.04	0.05*	0.02	0.02
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Increased input prices+	-1.04***	-0.79***	-0.36	-0.17	-1.04***	-0.77***	-0.35	-0.16
	(0.22)	(0.24)	(0.38)	(0.40)	(0.22)	(0.24)	(0.38)	(0.40)
Death or loss of livestock+	-0.61**	-0.57*	0.15	0.12	-0.59**	-0.56*	0.14	0.10
	(0.27)	(0.30)	(0.43)	(0.43)	(0.28)	(0.30)	(0.43)	(0.44)
Illness of head/spouse+	-0.42	-0.27	-0.81*	-0.75	-0.41	-0.25	-0.81*	-0.75
	(0.39)	(0.38)	(0.48)	(0.47)	(0.39)	(0.38)	(0.48)	(0.47)
Market(minutes)(ln)	-0.26**	-0.27**	-0.20*	-0.22*	-0.26**	-0.27**	-0.20*	-0.22*
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Perceptions on causes of poverty		0.87***		0.99***		0.91***		0.98***
		(0.26)		(0.29)		(0.26)		(0.29)
Openness to change		0.17		0.70***		0.15		0.72***
		(0.26)		(0.21)		(0.26)		(0.21)
Exposure to media and information		0.12		0.25		0.12		0.25
		(0.19)		(0.16)		(0.19)		(0.16)
Travel outside residence		0.15		0.53***		0.14		0.53***
		(0.23)		(0.19)		(0.23)		(0.19)
Bakko-Sire+	0.03	0.05	0.27	0.46	0.06	0.05	0.26	0.44
	(0.37)	(0.39)	(0.36)	(0.35)	(0.38)	(0.40)	(0.36)	(0.35)
Hettosa-Tiyyo+	-0.30	-0.34	-0.25	-0.34	-0.30	-0.34	-0.25	-0.34
	(0.30)	(0.30)	(0.30)	(0.28)	(0.30)	(0.30)	(0.30)	(0.28)
Constant	6.55***	7.04***	5.87***	6.99***	6.85***	7.23***	5.79***	6.92***
	(1.55)	(1.53)	(1.59)	(1.63)	(1.57)	(1.54)	(1.59)	(1.63)
Observations	302	302	301	301	302	302	301	301
R-squared	0.24	0.28	0.16	0.26	0.23	0.28	0.16	0.26

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. #Note: the following indicators were controlled but the coefficients were not statistically significant: size of land holdings, livestock holdings, dependency ratio, distance to- asphalt road, micro-finance; dummies for experience of shocks including too much rain/flood, livestock diseases, illness of family member other than household head/spouse; and other internal traits such as locus of control, self-esteem, trust in others, envy/competitiveness. +Binary.

Table A5. 4. Correlation of aspirations and other factors with life satisfaction and/or happiness of the household head

	(1) BestA1	(2) BestA2	(3) HappyA1	(4) HappyA2	(5) BestE1	(6) BestE2	(7) HappyE1	(8) HappyE2
Aspirations Head	0.24*	0.29**	0.42***	0.41***				
	(0.13)	(0.13)	(0.14)	(0.14)				
Expectations Head					0.27	0.37**	0.27	0.34**
					(0.17)	(0.17)	(0.16)	(0.16)
HH head Age31-50	-0.26	-0.09	0.20	0.35	-0.21	-0.03	0.29	0.43
	(0.40)	(0.35)	(0.46)	(0.47)	(0.39)	(0.34)	(0.45)	(0.46)
HH head Age above51	-0.53	-0.35	-0.00	0.26	-0.48	-0.28	0.10	0.35
	(0.42)	(0.39)	(0.49)	(0.50)	(0.41)	(0.38)	(0.48)	(0.50)
Head education: 0-4	0.06	-0.03	-0.32	-0.52*	0.02	-0.10	-0.38	-0.59**
	(0.25)	(0.25)	(0.28)	(0.28)	(0.26)	(0.25)	(0.28)	(0.28)
Head education: 5-8	-0.43*	-0.48*	-0.30	-0.51*	-0.49**	-0.55**	-0.33	-0.56*
	(0.24)	(0.25)	(0.27)	(0.29)	(0.24)	(0.25)	(0.28)	(0.29)
Head education: 8+	-0.67**	-0.75***	-0.61*	-0.86***	-0.75***	-0.85***	-0.65**	-0.92***
	(0.28)	(0.28)	(0.32)	(0.32)	(0.29)	(0.29)	(0.33)	(0.32)
HH size(ln)	0.61**	0.42	0.34	0.07	0.59**	0.37	0.37	0.06
	(0.26)	(0.27)	(0.31)	(0.31)	(0.27)	(0.27)	(0.31)	(0.31)
HH head in business/wage	-0.17	-0.15	-0.35	-0.28	-0.17	-0.13	-0.34	-0.25
	(0.20)	(0.21)	(0.22)	(0.24)	(0.20)	(0.21)	(0.23)	(0.24)
Change in Incom (2006-10)	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Income per-adult equiv.(ln)	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Expenditue quintile	0.18**	0.13*	0.22***	0.18**	0.18**	0.12	0.22***	0.17**
	(0.07)	(0.07)	(0.08)	(0.08)	(0.08)	(0.07)	(0.08)	(0.08)
Wealth quintile	0.27**	0.30**	0.32**	0.37***	0.27**	0.31**	0.33**	0.38***
	(0.13)	(0.13)	(0.14)	(0.14)	(0.13)	(0.13)	(0.14)	(0.14)
Value of assets (ln)	0.22*	0.16	-0.01	-0.08	0.22**	0.17	-0.01	-0.08
	(0.11)	(0.11)	(0.12)	(0.12)	(0.11)	(0.11)	(0.12)	(0.12)
Increased input prices	-0.70***	-0.51*	-1.16***	-1.08***	-0.68**	-0.46	-1.14***	-1.04***
	(0.26)	(0.29)	(0.37)	(0.37)	(0.26)	(0.29)	(0.37)	(0.37)
Road (minutes)(ln)	0.04	0.04	0.11*	0.11**	0.05	0.05	0.11*	0.12**
	(0.04)	(0.04)	(0.06)	(0.06)	(0.04)	(0.04)	(0.06)	(0.06)
Market(minutes)(ln)	0.13	0.20**	-0.14	-0.10	0.14	0.22**	-0.12	-0.08
	(0.09)	(0.10)	(0.11)	(0.11)	(0.09)	(0.10)	(0.11)	(0.11)
Micro-finance (minutes)(ln)	0.29**	0.23*	0.08	0.05	0.30**	0.23*	0.08	0.05
	(0.13)	(0.13)	(0.16)	(0.16)	(0.13)	(0.13)	(0.16)	(0.16)
Perceptions on causes of poverty		0.73***		0.36		0.71**		0.34
		(0.28)		(0.34)		(0.28)		(0.34)
Trust		-0.24**		-0.15		-0.26**		-0.16
		(0.10)		(0.12)		(0.10)		(0.12)
Exposure to media and information		0.18		0.50**		0.19		0.51**
		(0.16)		(0.20)		(0.16)		(0.20)
Travel outside residence		0.22		-0.02		0.19		-0.04
		(0.19)		(0.22)		(0.19)		(0.23)
Bakko-Sire	0.95***	0.98***	0.25	0.35	1.02***	1.07***	0.35	0.45
	(0.29)	(0.30)	(0.32)	(0.33)	(0.30)	(0.30)	(0.32)	(0.32)
Hettosa-Tiyyo	0.72***	0.74***	0.02	-0.08	0.76***	0.79***	0.04	-0.05
	(0.22)	(0.23)	(0.25)	(0.26)	(0.23)	(0.23)	(0.26)	(0.27)
Constant	-0.75	-0.08	5.57***	6.54***	-0.82	-0.14	5.29***	6.31***
	(1.14)	(1.19)	(1.30)	(1.31)	(1.13)	(1.19)	(1.27)	(1.29)
Observations	373	373	372	372	373	373	372	372
R-squared	0.30	0.34	0.21	0.25	0.30	0.35	0.21	0.24

Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01. #Note: the following indicators were controlled but the coefficients were not statistically significant: size of land holdings, dependency ratio; dummies for experience of shocks including too much rain/flood, livestock diseases, illness of household head/spouse, illness of other family member; and other internal traits such as locus of control, self-esteem, attitude to change, envy/competitiveness. +Binary.

Table A5. 5. Pairwise correlation amongst internal (or psychosocial) indicators

	Aspindex	LCi	SEi	OCi	Ei	Ti	SWi	TPi	Ri
Aspindex	1.0000								
LCi	0.2253	1.0000							
SEi	0.2639	0.5859	1.0000						
OCi	0.1242	0.2223	0.2894	1.0000					
Ei	0.0422	-0.0668	-0.0879	0.2014	1.0000				
Ti	0.1337	0.2038	0.1973	0.0358	-0.0431	1.0000			
SWi	0.2559	0.0300	0.0846	0.0575	0.0244	-0.1500	1.0000		
TPi	0.0383	0.0505	0.1183	0.1593	0.1036	0.1321	0.0377	1.0000	
Ri	0.0228	0.0892	0.0378	-0.0471	-0.0245	0.1594	-0.0254	-0.0411	1.0000

Note: the indicators denote standardized indices of: the aspirations index (Aspindex), internal locus of control (LCi), self-esteem (SEi), openness to change (OCi), Envy/competitiveness (Ei), trust in others (Ti), subjective well-being (SWi), discount factor/time preference (TPi), risk preference (Ri).

Figure A 1. Propensity score distribution by "treatment" status