Farm Household Economic Behaviour in Imperfect Financial Markets

Empirical Evidence and Policy Implications on Saving, Credit and Production Efficiency in Southeastern Ethiopia

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Abstract

Financial markets in developing countries are imperfect and are likely to affect decision-making behaviour of economic agents, especially smallholder farm households. This thesis, comprising four articles, aimed to understand and explain farm household economic behaviour with reference to saving, credit and production efficiency under imperfect financial market conditions. It is based on data obtained from farm household survey conducted in two districts of southeastern Ethiopia from September 2004 to January 2005. Data was analysed using stochastic frontier analysis and limited dependent variable econometric tools.

In article I, farm household saving behaviour and its determinants were studied. Results show that, on average, a farm household saved 37% of its farm income in financial and physical assets. However, more than 90% of savers held their savings outside formal financial institutions. Such saving behaviour of farm households was affected by factors related more to incentives and opportunities to save than to ability to save. In Article II, borrowing behaviour of farm households was analysed by considering sectoral choice of farm households among formal, semiformal and informal credit sectors and factors contributing to their choice. The informal credit sector was found to dominate sectoral choice of the farm households even though this sector charged the highest interest rates. Factors other than the interest rate, i.e., loan processing time, type of loan, credit information and loan size, significantly affected this borrowing behaviour of the farm households. In Article III, technical efficiency of smallholder farmers was estimated using a stochastic frontier analysis. There was about 12% efficiency differential between credit-constrained and credit-unconstrained farm households, ceteris paribus. In Article IV, farm households' demand for credit and its determinants were investigated. It was found that farm households had credit demand for production and consumption purposes, whereas the formal credit sector targeted credit only for production purpose, although production and consumption purposes are closely related.

In conclusion, imperfect financial markets adversely affect saving, credit demand, credit sectoral choice and production behaviours of farm households. This study suggests some policy measures, which may help to redress the adverse effects identified and to enhance development of rural financial markets and institutions.
Keywords: agricultural finance, asymmetric information, credit demand, formal finance, informal finance, rural credit, smallholder farmers, technical efficiency.

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Contents

Appendix

Introduction, 7

Background, 8
  Ethiopia and its economy, 8
  Rural/Agricultural sector and farm households, 9
  Financial sector and farm household economic behaviour, 10
  Research motivation and purpose, 11
  Research questions, 12
  Scope and limitations of the study, 13

Methodological considerations, 14
  Description of the study area, 14
  Sample selection and data collection procedure, 14
  Data analyses, 15
    Efficiency measurement, 15
    Limited dependent variable model, 16

Review of related literature, 17
  Finance and economic development, 17
  Effects of rural financial market on economic behaviour of farmers, 18
  Factors for rural financial market development, 20
    Government intervention in rural financial markets, 20
    Land property rights, 20
    Population density, 20
    Saving mobilisation, 21
    Institutional diversity, 21
    Informal finance and rural financial markets, 22

Summary of main results and discussions, 24
  Article I: Farm households’ saving behaviour, 24
  Article II: Credit sectoral choice of farm households, 25
  Article III: Influence of credit constraints on technical efficiency, 27
  Article IV: Farm households’ demand for credit, 27

Conclusions and policy implications, 29

Contributions of the thesis, 31

Suggestions for further research, 33

References, 34

Acknowledgements, 39
Appendix

Articles I-IV

The present thesis is based on the following articles, which will be referred to by their Roman numerals (I-IV):


II. Komicha, H. H. Credit sectoral choice of farm households and its determinants in imperfect credit markets of Southeastern Ethiopia. Submitted to *The Developing Economies*.


IV. Komicha, H. H. Farm household demand for credit and its determinants in imperfect credit markets of Southeastern Ethiopia. Submitted to *Quarterly Journal of International Agriculture*.

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Dedicated to my mother Hawi Sheko, my father Hamda Komicha and my son Fuad Hussien, for their irreplaceable love which remains with me forever although we are physically separated by their sudden death.
1. Introduction

Almost three decades ago, Theodore W. Schultz, in his 1979 Nobel Prize lecture, stated: "Most of the people in the world are poor, so if we knew the economics of being poor we would know much of the economics that really matters." The core message of this quotation prompted the initiation of the current work, resulting in this thesis. In particular, this thesis looks at the economic behaviour of smallholder farm households under imperfect financial market conditions in Ethiopia, one of the poorest countries of the world.

The study focuses on the role of an imperfect rural financial market in saving, borrowing and production behaviours of farm households. Rural financial markets in developing countries in general, and in Ethiopia in particular, are imperfect. They are typically segmented into formal, semiformal and informal sectors, with very small market shares of the formal and semiformal sectors in rural areas. The major reasons for the small shares of the two sectors of the market in rural areas are related to asymmetric information, monitoring and contract enforcement problems. Besides, underdeveloped physical and communication infrastructures enormously influence farmers and rural entrepreneurs' access to financial markets. As a result, farm households face credit constraints in financing their farming operations, on-farm investment and consumption.

Although institutions providing financial services to rural residents, who are the majority in developing countries, are vital for proper functioning of the rural economy, such institutions are either lacking in most areas or inadequate, if they exist. Absence of effective financial institutions in rural areas has compounded effects on the economic performance of farmers and rural entrepreneurs. Among these, saving, borrowing and production behaviours of farm households are studied in this thesis.

This thesis is a synopsis of the main results of four related studies. The articles focus on economic behaviours of farm households in saving, credit demand, credit sectoral choice and technical efficiency, and on factors affecting these behaviours under imperfect financial market conditions prevalent in southeastern Ethiopia. Moreover, the thesis contains additional background information and a brief discussion.

The thesis is structured as follows. The next section presents background information on the Ethiopian economy in general, and the rural/agricultural and the financial sectors, in particular. It also discusses what motivated the research, questions addressed, and the scope and limitations of the study. The next three sections discuss methodological considerations, a review of related literature and the main results. The last three sections present conclusions and policy implications, contributions of the thesis and suggestions for further research.
2. Background

2.1 Ethiopia and its economy

Ethiopia is located in East Africa (which is also known as the Horn of Africa region) between geographic co-ordinates of 3°24' and 14°53'N and 32°42' and 48°12'E, covering a land area of 1.12 million square km, of which 7,444 square km is covered by water (World-Factbook, 2007). It has a population of about 77 million and per capita income (in purchasing power parity measure) of about US$ 1000 in year 2006 (World-Factbook, 2007). In most economic measurements, Ethiopia is one of the poorest countries of the world. Its economy depends heavily on the agricultural sector, evident in agriculture’s contribution to the national economy, which is about 46.7% of GDP, 90% of export earnings and 85% of employment of economically active population, whereas the industrial and service sectors comprise the remaining 12.9% and 30.4% of GDP, respectively (EEA, 2004). The major export commodities of Ethiopia are coffee, khat¹, oilseeds, cutflowers, livestock and livestock products, and more recently gold, with coffee having the lion’s share (e.g., about 41% of export revenue in 2004/05) (World-Factbook, 2007; EEA, 2004). Since the share of manufacturing and service sectors of the economy is small, the Ethiopian economy is predominantly agrarian. The larger share in labour of the agricultural sector relative to the sector’s contribution to the GDP indicates that agriculture is at lower level of productivity than the other sectors of the economy. Between 1962 and 2002, the agricultural sector grew annually by 1.89% with 2.1%, 1.5% and 2.2% during the Imperial, Military and EPRDF regimes, respectively (Tafesse, 2005), whereas population grew by an average of about 2.9% during the period (CSA, 2006). The low performance of the agricultural sector may be attributed to underdeveloped rural infrastructure such as roads, transportation, communication, electricity and water supply, and absence of rural financial institutions that facilitate rural economic development. Moreover, agricultural production depends heavily on rainfall and is often affected by frequent weather fluctuations. Nationally, less than 4% of the farms are irrigated although the country has large potential for irrigation farming, given its water resource (MOA, 1995); indeed, many refer to Ethiopia as “the water tower of East Africa”. Yet, Ethiopia lacks the necessary economic growth to cope with the growing population.

With regard to economic policies, three milestones can be considered. That is, the country had a market-oriented economic policy during the Imperial Period (1930-1974). Prior to 1975, there was private land ownership but most farmers were tenants of a few large landowners of the feudal system. During that period, there were private banks in the country engaged in the provision of financial services, among others. During the Military Regime (1974-1991), the country was under

¹ Khat (Catha edulis) is a shrub or small tree with ever-green leaves native to the tropical East Africa and the Arabian Peninsula, chewed for its use as a mild to moderate stimulant. It generates the highest foreign exchange earnings next to coffee for Ethiopia in exports to some Middle-East and European countries (EEA, 2006).
socialist command economy. During that period, private ownership of land was abolished and state ownership of land was enforced after the 1975 “land to the tiller” proclamation, in which farmers were given the right to cultivate land without ownership rights. The land use rights were frequently redistributed among households by local administrative bodies. That led to the continuous decline in per capita land available for households (Adinew, 1991). During this period, private banks were also nationalized, and subsidized public formal credit system targeted farmers’ cooperatives, which were collectivized involuntarily. Farmers who were not members of cooperatives were excluded from public formal credit system. When a new government, the EPRDF, came to power in 1991, it reintroduced a market-oriented economic policy. In particular, Ethiopia began implementing structural adjustment program (SAP) in 1992 similar to on-going structural changes in most developing countries (Balassa, 1982) at the time and particularly in Sub-Saharan African countries. Under the current government, land still remained under state ownership and farmers continued to have only use rights through further redistribution of land.

In the process of implementing SAP, Ethiopia has laid out different policies and strategies. It devised a comprehensive development policy referred to as Agricultural Development-Led Industrialization (ADLI) in 1994, which put the agricultural sector at the centre of the development process. To this effect, it has devised and implemented several complementary reform programs, one of which was the financial sector reform. The financial sector reform has focused on liberalizing the financial sector to improve the efficiency of financial services in rural and urban areas by allowing private investment in the sector. Due to this reform, private banking has begun and the number of such banks has increased ever since. This has led to the decline in the credit market share of the public banks from 90% in 1999/2000 to about 70% in 2005/06 (NBE, 2007). However, the public banks have continued to dominate the financial system of Ethiopia. Despite their dominance, the public banks have contributed little to the rural economy in general and the farm households in particular. As a result, the informal and semiformal sectors have significant role in rural credit supply. However, farm households, and especially the smallholders operate under credit constraints.

2.2 Rural/Agricultural sector and farm households

Schultz’s 1979 Nobel Prize lecture also emphasized agriculture and its economics, where he stated: “Most of the world’s poor people earn their living from agriculture, so if we knew the economics of agriculture, we would know much of the economics of being poor.” The importance of the rural/agricultural sector thus relates to the share of rural inhabitants in total population that make a living from this sector. The Ethiopian countryside hosts about 85% of the Ethiopian population, who make livelihoods from agriculture and related activities. Most farm households are engaged in crop-livestock mixed farming, diversifying in different crops and animals (Kassa, 2003). They diversify in order to cope with the risks inherent in the agriculture, related to weather, diseases, pests, prices, and so on. Smallholder farmers produce more than 90% of total agricultural production from 95% of the total farm land (MOA, 1995). However, the agricultural sector experiences very
low productivity, by any standard, which may be attributed to low level of adoption of yield-enhancing technologies, poor farm management practices and inefficient production systems. As a result, farm households produce at subsistence level and hence generate inadequate surplus to the market. The nonfarm sector is also generally underdeveloped in rural areas. The rural sector experiences inadequate public infrastructure such as roads, transportation, electricity, telecommunication, and lacks supporting financial institutions. Clearly, lack of these essential infrastructure and institutions prevents the agricultural sector from developing to a higher productive stage. It has to be noted that a farm household is both a producer and a consumer unit, whose objective is both revenue/profit and utility maximization subject to various constraints. On the one hand, a farm household is the main source of farm labour supply for agricultural production. On the other hand, it is the consumer of agricultural and industrial products. The rural factor and product markets are imperfect, and, as a result, production and consumption decisions are often inseparable or weakly separable (Singh et al., 1986). Yet, formal financial institutions lend (if at all) only for production purposes. Although the agricultural sector is short of adequate investment, it is still the main strategic sector in Ethiopian economy and is vital to spur meaningful economic growth and development (Legesse, 2003). A failure in this sector would affect major components of the national income accounts besides creating food deficits, reduced private consumption, savings and investment levels, among others (Gudeta, 2003).

2.3 Financial sector and farm household economic behaviour

As explained in the previous sub-sections, the Ethiopian rural economy in general, and the agricultural sector in particular, operate under imperfect rural financial market conditions. This is partly because the rural economy is dependent on agriculture and agriculture, inherently risky, creates disincentives for financial institutions affecting their lending decisions and investment decisions (Pederson, 2003). Inappropriate government intervention in providing legal, property, regulatory and financial frameworks that facilitate the development of rural financial markets can also cause such disincentives. Since the 1990s, several economic policies and programs have been designed and implemented in Ethiopia, viz., rural development program, food security program, industrial development program and poverty reduction program (Diao and Pratt, 2007; IMF, 2006). Attempts have also been made to liberalize the financial sector as part of the overall economic reform program. As a result, the banking sector, which stayed under government monopoly for several decades, has opened itself for domestic private investment\(^2\), and since then several private banks and insurance companies have entered the financial market. Towards the end of 2006, the Ethiopian financial sector comprised 1 central bank (i.e., the National Bank of Ethiopia), 9 commercial banks (of which 2 are publicly owned), 1 development bank (i.e., the Development Bank of Ethiopia), 27 microfinance institutions (MFIs), 1 pension fund (i.e., the

\(^2\) The reform has not allowed foreign financial institutions to enter the banking sector in Ethiopia, which means that the sector is subject to limited international competition.
Social Security Authority) and several savings and credit associations (IMF, 2006; NBE, 1996).

Compared to the public sector banks, the private financial institutions that recently entered the financial market are smaller and have smaller market shares. With the exception of the microfinance institutions (MFIs), private banks have limited coverage in rural areas, mainly due to their sizes but also for other reasons such as high transaction costs and default risk aversion. In view of this, for example, agricultural input credit has recently been organized through third-party guarantee of regional governments for loans from commercial banks. The third-party guarantee, as linked to the guarantor’s own budget, is supposed to shield against default risk that commercial banks would not be ready to face in the absence of such a mechanism. However, it is reasonable to think that as long as the credit supply is pegged to the guarantor’s annual budget, which obviously has an upper bound, this scheme is also likely to exclude some farm households who would like to participate in the credit market. Thus, the third-party guarantee scheme renders little to reduce the adverse effect of the credit market imperfection.

Imperfect financial market conditions constrain farm households’ access and use of crucial financial services such as saving, borrowing and other financial transactions, which are important in facilitating savings mobilization and resource allocation in the economy.

2.4 Research motivation and purpose

Many previous studies have shown that financial market conditions affect economic growth and development of countries (Bencivenga and Smith, 1991; Benhabib, 2000; Goldsmith, 1969; Jeanneney et al., 2006; Levine, 1997; McKinnon, 1973; Romer, 1986; Shaw, 1973). It is a general notion that rural financial markets in developing countries are imperfect (Yadav et al., 1992). This imperfection generally affects economic performances of these countries but more seriously that of farm households. Several previous studies in Ethiopia also indicate that farm households operate under constrained financial market condition (EEA, 2007; EEA, 2005; Emana et al., 2005; Gobezie, 2005; EEA, 2004; Kassa, 2003; Croppenstedt et al., 2003; Legesse, 2003; Jabbar et al., 2002; Mekonnen, 2002; Freeman et al., 1998). This is likely to affect saving and borrowing behaviours and technical efficiency of farm households. However, empirical studies showing the effect of imperfect rural financial markets at microeconomic level, particularly at farm household level, are generally few in Ethiopia but absent in the areas studied.

As argued initially, underdeveloped financial markets adversely affect economic agents, and governments strive to reduce the adverse effects by devising appropriate intervention policies and supporting institutions to enhance the development of financial markets. This requires careful consideration of salient factors in the intervention process. Many studies suggest factors to be considered in developing rural financial market of developing countries (e.g. Lamberte et al. 2006; de Aghion and Morduch, 2005; Gonzalez-Vega, 2003; Ghosh et al., 2000, Feder, 1993; Feder et al. 1988). These are related to e.g. government intervention, land property rights, population density, saving mobilization and institutional
diversity. They suggest that (1) appropriate level of government intervention, in terms of macroeconomic stability and institutional infrastructure, is necessary to support financial market development; (2) since evidence shows that land ownership security strongly correlates with capital investment in farms and easier access to credit at lower rates of interest, farm households need to have legally acceptable land property rights; (3) given low population densities in rural areas, a broader array of products (such as credit, payment, transfer services) need to be developed to many customer segments (e.g. poor, nonpoor, farmer, rural entrepreneur) for the financial market to expand to rural areas; (5) the importance of saving mobilization for financial deepening and sustainable financial intermediation (Shaw, 1973); and (4) there needs to be institutional diversity in financial markets such as the existence of banks for the smooth functioning of nonblank institutions and the positive role of informal finance.

The aim of this study is to understand and explain the behaviour of farm households with respect to saving, credit demand, borrowing and technical efficiency under imperfect rural financial market conditions of southeastern Ethiopia. Understanding the behaviour of farm households under imperfect financial market conditions would help in devising appropriate policies to reduce the financial market imperfection and minimize its adverse effects. This thesis has focused on four specific objectives contained in four articles. The first article analyses the nature of farm household saving by identifying and explaining the types and extent of savings and demographic, socioeconomic and institutional factors affecting saving behaviour of farm households. The second article analyzes farm households’ choice probabilities among informal, semiformal and formal credit sectors, and identifies demographic and socioeconomic factors affecting their sectoral choices. The third article estimates technical efficiency of credit-constrained and -unconstrained farm households by disaggregating the sample based on credit-constraint status of the farm households, and identifies factors additionally affecting their technical efficiencies. The last article estimates farm households’ demand for credit and its influencing factors.

In light of the above-mentioned factors, the results of this study are relevant to devise appropriate intervention policies and institutions that can improve the financial market conditions that affect the behaviour of farm households. Improving financial market conditions in general but those of the rural financial market in particular is likely to improve the economic behaviour of the farm households and hence the rural economy.

2.5 Research questions

The research problem was approached by answering the following main research questions:

- In light of imperfect rural financial market in the study areas, how do farm households save their financial and physical assets and what factors affect their saving behaviour?
- What is the nature of farm households’ demand for credit under imperfect rural credit market, and what factors affect their demand?
- How do farm households choose among credit sectors under credit market imperfection?
- Does credit constraint influence technical efficiency of farm households, and what are other factors contributing to their technical inefficiencies?

2.6 Scope and limitations of the study

This study is a microeconomic analysis based on data obtained in a cross-sectional survey of farm households in Merti and Adamitullu Jido Kombolcha districts of Oromia Regional State, Ethiopia. In a strict sense, the findings are pertinent mainly to the study areas, but may also be extended to other areas with similar agroecological and socioeconomic characteristics. However, since there can be heterogeneity among farmers in even slightly varying socioeconomic and agroecological settings, more of similar studies in other areas will allow to develop comprehensive policy recommendations. More importantly, further studies require large and rich dataset, such as longitudinal and panel dataset, which was not obtained for this study due to time and budget constraints.
3. Methodological considerations

3.1 Description of the study area
The survey was conducted from September 2004 to January 2005 in Merti and Adamitullu-Jido-Kombolcha (AJK) districts of Oromia Region, Ethiopia. These districts are located about 200 and 160 km, respectively, to the southeast of the capital, Addis Ababa (Finfinne) (see the map in Fig. 1). Currently, Ethiopia is divided into nine regional states and two autonomous city administrations. Oromia is the largest regional state in terms of land and population sizes, each accounting for about 40% of the country (CSA, 2006). Oromia comprises 14 administrative zones at the time of the survey, including Arsi and East Shewa. The study area focuses on two districts in these two zones (see the map in Fig. 1).

![Figure 1: Map showing the study areas](image)

3.2 Sample selection and data collection procedure
The study used farm household survey data collected using structured questionnaire, which covered crop and livestock production, off-farm and non-farm activities, income, consumption, saving and borrowing activities of the farm households. The farm households were randomly selected from six Farmers Associations (FAs), based on agro-ecological zones of the two districts – four from Merti and two from AJK (Fig. 1). The districts have diverse physical and socioeconomic characteristics. Using FA-level list of farm households as a sampling frame, 240 sample farm households were randomly selected. About 70% of the total sample farm households were selected from Merti and 30% from AJK district (Table 1). Survey enumerators interviewed heads of farm households by using a structured questionnaire by visiting the farm households at their farmsteads. Individual visits minimized external noise that might affect response behaviour of
farm households in dealing with sensitive questions such as income and savings. They also helped minimize the usual problem of survey research – the non-response rate – as the interviewer and the respondent heads of farm households directly interacted with each other, allowing clarification of any possible misunderstandings in the questions during the interview sessions and taking appointments at times appropriate for the respondent.

Table 1: Total and sample farm households by location

<table>
<thead>
<tr>
<th>District/Farmers’ association</th>
<th>Total farm household</th>
<th>Sample farm households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merti</td>
<td>1584</td>
<td>169</td>
</tr>
<tr>
<td>Golugota (L)</td>
<td>443</td>
<td>50</td>
</tr>
<tr>
<td>Waticha-dole (L)</td>
<td>370</td>
<td>34</td>
</tr>
<tr>
<td>Homba (M)</td>
<td>438</td>
<td>40</td>
</tr>
<tr>
<td>Re’ec-Amba (H)</td>
<td>333</td>
<td>45</td>
</tr>
<tr>
<td>Adamitulu-Jido-Kombolcha</td>
<td>672</td>
<td>71</td>
</tr>
<tr>
<td>Walinbula (M)</td>
<td>312</td>
<td>30</td>
</tr>
<tr>
<td>Haleku (L)</td>
<td>360</td>
<td>41</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2256</strong></td>
<td><strong>240</strong></td>
</tr>
</tbody>
</table>

Note: L, M and H refer to lowland, midland and highland altitudes, respectively.

3.3 Data analyses

For each article, a specific analytical tool was used. However, descriptive statistics were used in all articles and limited dependent variable econometric models were used in most of the articles. More specifically, censored regression (tobit) model was used in Article I and IV and multinomial logit model in Article II. In Article III, a stochastic frontier analysis was used in the first stage estimation and the ordinary least squares (OLS) regression method was used in the second stage. The rationale for the selection of these methods is briefly discussed below.

3.3.1 Efficiency measurement

In the literature, there are two widely used methods of measuring technical efficiency: the nonparametric data envelopment analysis (DEA) and the parametric stochastic frontier analysis (SFA). The main difference between the two methods is that in DEA, a functional form is not specified for the production technology and the error terms are not accounted for, whereas in SFA, a functional form is specified for the production function and the error terms are accounted for in the efficiency estimations. In other words, all deviations from the frontier are considered inefficiency in DEA whereas this is decomposed into inefficiency and random errors in SFA (Dorfman and Koop, 2005; Wadud and White, 2000; Sharma et al., 1999; Battese and Coelli, 1995; Bravo-Ureta and Pinheiro, 1993; Färe et al., 1990; Farrell, 1957). Since the data used in this study are obtained from responses of farmers based on mental accounting, because farmers are unable to do proper accounting, it is reasonable to prefer SFA to DEA, which accounts for such data noise. Technical efficiency measurement can be either output oriented or input
oriented. In Article III, output-oriented technical efficiency of farm households was measured by specifying the Cobb-Douglas production function of SFA.

3.3.2 Limited Dependent Variable Models

This study focuses on farm household economic behaviour based on responses to survey questions. Some of these responses are discrete choices of the farm households. In Article I, since some farm households did not have savings (or had zero savings), while others had positive savings, use of OLS regression, which truncates the zero observations away in estimations would bias the estimates and hence be inappropriate. Instead, under such a condition a censored regression (tobit) is appropriate (Tobin, 1958). In Article II, where credit sectoral choice probabilities of farm households were estimated, the dependent variable was limited between discrete choices of the respondents among options of no credit, formal credit, semiformal credit or informal credit, in which either multinomial logit (MNL) or multinomial probit (MNP) would be appropriate. However, MNL was preferred to MNP due to its computational convenience (Maddala, 1983). In Article III, although the technical efficiency estimates are bounded between zero and one (Battese and Coelli, 1995), because neither zero nor one occurred, the OLS regression method was used in the second stage estimation. In Article IV, where farm household demand for credit was estimated, the fact that some farm households had zero demand for credit, made use of censored regression appropriate. This prevents the data in which observed credit was zero from being discarded. Since the observed variables other than the credit variable – demographic and socioeconomic characteristics of farm households – are relevant for the study, tobit regression was pertinent to use in this case as well.
4. Review of related literature

4.1 Finance and economic development

This thesis focuses on the role of rural financial markets in saving, borrowing and production behaviours of farm households in the context of a developing country. It is thus important to make a conceptual distinction among some related terms: finance, rural finance, agricultural finance, rural credit and agricultural credit. Finance, in general, is the broadest concept encompassing all the other terms and representing the provision to meet operating and investment costs of an economic activity (Nelson and Murray, 1967). Rural finance is one of the broad divisions of finance, which comprises agricultural and non-agricultural finance, excluding financial services to urban households and firms. Agricultural finance specializes in the financing of the agricultural sector, which goes beyond provision of credit (Nelson and Murray, 1967). Rural credit is a narrower concept that specializes in provision of credit for rural households and firms, not only necessarily agricultural firms. Agricultural credit is the most specialized division, which provides credit service only to agricultural firms. Based on this distinction, “rural financial market” in this thesis refers to a market for rural financial services comprising agricultural finance, rural credit, and agricultural credit.

To understand the role of finance in economic development, it is worthwhile to consider macroeconomic theories. In this respect, we find three major developments: traditional growth theories (Goldsmith, 1969; McKinnon, 1973; Shaw, 1973), early endogenous growth literature (Romer, 1986), and recent endogenous growth literature (Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991). In the traditional growth theory, factor accumulation is considered the main driving force behind economic growth. Financial development can contribute to the growth of total factor productivity by either raising the marginal productivity of capital (Goldsmith, 1969) or improving the efficiency of capital allocations so as to increase the aggregate saving rate and investment level (McKinnon, 1973; Shaw, 1973). However, in the traditional framework, the capital stock suffers from diminishing returns to scale, which greatly limits the impact of financial development on growth.

Emergence of the endogenous growth literature pioneered by Romer (1986) provides important insights and new theories, underpinning the analysis of the relationship between financial development, productivity and growth. In this category of literature, endogenous technological progress might result in non-diminishing returns to capital through research and development, along with their positive externalities on aggregate productivity.

Consequently, the role of financial intermediation in raising productivity has been re-enforced in recent endogenous growth literature. Greenwood and Jovanovic (1990) develop an endogenous model, in which they highlight two essential functions of financial intermediaries in enhancing productivity and promoting growth, i.e., collecting and analyzing information on investment projects, and increasing investment efficiency through allocating funds to the projects with the
highest expected returns. Similarly, Bencivenga and Smith (1991) argue that by enhancing liquidity and mitigating idiosyncratic risk through risk diversification, the development of financial intermediaries improves the allocation efficiency of funds, thus contributing considerably to productivity growth.

Furthermore, the importance of portfolio diversification and risk sharing via stock markets in inducing sustained growth is explored in a number of studies (e.g., Levine, 1991; Saint-Paul, 1992). All these studies suggest that financial development can affect long-run growth through different channels and various aspects of innovation or productive activities (Jeanneney et al., 2006). Levine (1997) summarizes theoretical arguments that support more efficient and better functioning of financial systems for economic growth. He argues that financial institutions might foster capital accumulation and higher productivity growth by increasing diversification and reducing risk, mobilizing savings and allocating resources to their best uses, monitoring managers and exerting corporate control, reducing monitoring cost and facilitating exchange of goods and services.

The positive relationship between finance and growth has also received considerable support from empirical studies (e.g., King and Levine, 1993; Beck, Levine & Loayza, 2000; Levine, Loayza, and Beck, 2000). For example, Benhabib and Spiegel (2000) examine whether financial development affects growth solely through its contribution to factor accumulations via the channels suggested in the traditional growth theory, or whether it enhances economic growth via the channels of productivity improvement attributed to knowledge creation and technological progress, as predicted by the endogenous growth literature. Their results suggest that financial development is positively correlated with growth in both total factor productivity and capital accumulation. Recently, modern economic theories have shown that productivity is the sole viable engine for sustainable long-term economic growth. In this sense, the contribution of financial development to productivity enhancement should be more important than that to factor accumulations (Jeanneney et al., 2006).

In this connection, it is necessary to note that financial systems in developing countries comprise formal, semiformal and informal sectors, reflecting financial market segmentation and thus underdevelopment. This has implications for sectoral choice of farm households in their saving and borrowing decisions. Moreover, the formal sector is characterized by credit rationing (Ghosh et al., 2000), in which credit supply to the farm households and rural entrepreneurs are limited, with negative effects on production behaviour of farm households.

4.2 Effects of rural financial market on economic behaviour of farmers

Many studies suggest that rural financial markets affect performance behaviours of economic agents (Das and Ghosh, 2006; Hackbarth et al., 2006; Benhabib, 2000; Ghosh et al., 2000; Zeller et al., 1998; Levine, 1997; Deaton, 1992; Braverman and Guash, 1986; Adams and Vogel, 1986; Eswaran and Kotwal, 1986). One of these behaviours is saving behaviour of farm households. Rural financial market can affect saving behaviour directly and indirectly. Directly, the financial market is a
venue where interest income is paid for an asset saved at a financial institution, whereas indirectly it provides the farm household the possibility of borrowing in case of income downturn, smooth consumption and production (Liu and Hsu, 2006; Latruffe, 2004) so that the farm households do not need to save for precautionary reason. Since borrowing opportunity minimizes the farmers’ need for precautionary holding of financial assets, it frees such financial assets for possible investment activities.

Contrary to perfect financial markets, imperfect rural financial markets negatively affect farm household saving behaviour (Lamberte et al., 2006; Guirkinger, 2005; Rioja and Valev, 2004; Pederson, 2003; Meyer, 2002; Odedukun, 1988; Lipton, 1976). Firstly, even if lending institutions have adequate loanable capital to lend, existence of asymmetric information deters lending institutions from sufficiently lending to farmers (Pederson, 2003). Thus, this results in significant credit rationing of the farm households. Secondly, when farmers anticipate borrowing constraints, they limit their consumption and investment activities in the current period in order to save for the future period as a precautionary measure (Deaton, 1992; Deaton, 1991). This, in turn, leads to suboptimal resource allocation both at farm household and higher levels.

Rural financial market can also affect borrowing behaviour of farmers (Ndikumana, 2005; Jimenez and Saurina, 2004). If perfect, the rural financial market offers an opportunity for farmers to borrow to cover operational and investment costs, based on their creditworthiness. Imperfection in the rural financial market, to the contrary, limits this opportunity and hence constrains the production and investment frontiers of the farmers (Jabbar et al., 2002; Freeman et al., 1998). Especially in developing countries, where the resource base of the farmers is very limited, lack of access to credit amounts to inability to use modern productive inputs (Croppenstedt et al., 2003) such as inorganic fertilizers, herbicides and pesticides, which hampers their productivities.

Use of the right mix of production inputs, choice of appropriate production technologies, and investment behaviours of farm households have implications for production efficiency of a farm household (Blancard et al., 2006; Latruffe, 2004). Rural financial markets directly and indirectly affect procurement of optimal levels of productive inputs, choice of production technologies and investment behaviours of farm households in their decision-making process. As explained in the previous paragraphs, imperfection in the financial market is likely to affect all these and hence production inefficiency of farm households. Theory offers three possible approaches to the relationship between credit and technical efficiency (Latruffe, 2004). The first approach, referred to as the “free cash-flow” approach, stipulates a positive impact of credit on technical efficiency in that the indebted farm households face repayment obligations, which encourages them to increase their efforts and limit waste of factors of production. The second approach, which is based on agency theory, postulates a negative effect of credit on technical efficiency. It argues that information and monitoring costs linked to credit, borne by farm households, not by lenders, weigh on the technical efficiency of borrowers. The third approach, referred to as the credit evaluation approach, stipulates a reverse causality between credit and technical efficiency and argues that technical
efficiency positively acts upon the level of credit, which also suggests that lenders would rather lend to the most efficient farmers.

### 4.3 Factors for rural financial market development

As the literature reviewed in the previous section asserts, financial market development strongly affects the economic development of nations. However, nations differ in the extent of their financial market development. In particular, developing countries have lagged behind the developed economies in their financial market development. Recently, several studies have investigated what factors have to be considered in developing rural financial markets of developing countries. Such factors are reviewed below.

#### 4.3.1 Government intervention in rural financial markets

This factor relates to the role and extent of government intervention. The experience in most developing countries shows that governments play significant roles in rural financial development (Lamberte et al., 2006; Besley, 1994; Hoff and Stiglitz, 1990). Among others, maintaining macroeconomic stability and building institutional infrastructure to support financial market development (e.g., independent central bank, creating credit bureaus, strengthening creditor’s rights, increasing capacity of courts to fairly adjudicate commercial disputes, promoting the accountancy and auditing professions) are important areas for government intervention (Pederson, 2003). However, evidence also shows that excessive and inappropriate government interventions are counterproductive. Moreover, financial reform requires proper sequencing of the different components of the financial system (Levine et al., 2000), in which government plays an important role in setting priority areas in the reform process.

#### 4.3.2 Land property rights

Several studies show that individual rights to own land influence rural financial markets (Besley, 1995; Bardhan and Rudra, 1978). Although land is a source for potential wealth for rural households, some countries restrict land property rights to only use rights for an extended period (e.g. Ethiopia). However, evidence from studies of land ownership in Thailand, for example, demonstrates that with secure ownership comes greater capital investment in farms, as well as easier access to credit at lower rates of interest (Feder, 1993). Secure titling should promote more widespread use of land as collateral for loans, giving a boost to lending in rural areas which would deepen rural financial markets (Lamberte et al., 2006; Gonzalez-Vega, 2003).

#### 4.3.3 Population density

As is common in any market development, population density is a crucial factor in rural financial market development. The usual assumption in rural finance has been that low population density makes provision of financial services by formal sector institutions on a profitable basis almost impossible. However, Lamberte et al. (2006) argue that Mongolia, with its 1.5 persons/square km (compared with 114:1 in Indonesia) achieving a remarkable success in its formal financial institution both
in terms of outreach and viability, disproved this assumption. Given the low population densities in rural areas, providing a broader array of products (e.g., credit, payment, transfer services) to many customer segments (e.g., poor, nonpoor, farmer, rural entrepreneur) makes a strong economic sense for banks to expand to rural areas (Lamberte et al., 2006). The conclusion is that population density is one key challenge – among many – that must be considered in developing workable business models for rural financial institutions, but if innovative financial products are developed and used, the problem of low population density cannot be insurmountable for rural financial market development.

4.3.4 Saving mobilization

Evidence in Latin American and Asian countries shows that saving mobilization is a key activity in building a sound financial system (Lamberte et al., 2006; Amel et al., 2004; Gonzalez-Vega, 2003; Roberts and Hannig, 1998; Deaton, 1992; Bencivenga and Smith, 1991; Braverman and Guash, 1986; Begashaw, 1978). If there is demand for reliable and safe deposit services, and if the financial system is to carry out its major functions effectively and efficiently, saving is essential. However, in developing countries savings are often undermobilized. Two commonly cited underlying causes are: (1) prevalence of inappropriate saving products and poor services by depository institutions; and (2) lack of confidence in the safety or liquidity of financial institutions by rural people (de Aghion and Morduch, 2005; Gonzalez-Vega, 2003; Ghosh et al., 2000; Feder, 1993). Therefore, in order to effectively and efficiently mobilize savings, not only do saving products appropriate for rural savers need to be developed and depository institutions need to improve their services to this category of the population, but also the institutions need to win the confidence of the rural people by building easy and friendly saving and withdrawal procedures.

There is a murky experience of financial cooperatives in several developing countries. This is because they are promoted enthusiastically before proper regulatory and supervisory requirements were put in place, leaving a loophole for mismanagement of funds (Lamberte et al., 2006) and inadequate resources are provided for upfront education about cooperative enterprise management and the importance of transparency (i.e., accounting, control and audit). This situation leads to mistrust of farm households to channel their savings through these institutions. Moreover, credit unions are community based and member owned and they often exclude some members of a wider community. Thus, such institutions fail to mobilize all potential resources outside a particular community. For example, microfinance institutions are oriented towards reducing poverty by targeting the poor, and yet exclude the non-poor who do not have access to credit, and therefore are not inclusive (Lamberte et al., 2006; Coleman, 2006; Buckley, 1997). For such institutions to play significant role, they need to adopt an inclusive client approach.

4.3.5 Institutional diversity

Institutional diversity play central role in the development of rural finance. Banks, nonbank financial institutions and others bring competition into service provision to the rural areas, and strengthen the rural economy (Lamberte et al., 2006; Conning,
One of the reasons for low level of rural financial market development in LDCs is the presumption that farmers in LDCs are too poor to save, as they produce little marketable surplus. Formal financial institutions find them too costly to give service to the poor and as a result, the majority continued seeking services from informal institutions even if these institutions charge higher interest rates because of their monopoly power. Under this condition, nonbank financial institutions play important roles in meeting financial requirements of farm households and rural entrepreneurs (Carpenter and Jensen, 2002; Chakrabarty and Chaudhuri, 2001; Bose, 1998; Chung, 1995; Bouman, 1990; Braverman and Guash, 1986; Begashaw, 1978). Although core financial services can be efficiently provided through banks, banks demonstrated bias towards bigger business clients (Bigsten et al., 2003) and were concentrated in urban centres, which is a clear indication of exclusion of the rural areas. Since banks provide core deposit, payment and monetary transfer services (Lamberte et al., 2006), they are necessary to expand financial services to rural areas. Moreover, institutional diversity is likely to bring the competition into rural financial market and thereby lower costs of borrowing to the rural poor.

4.3.6 Informal finance and rural financial markets

Traditionally, there seems to be antagonism towards informal finance and a tendency to undermine its contribution to economic development (Emana et al., 2005; Carpenter and Jensen, 2002; Arelo, 1993; Christensen, 1993; Bolnick, 1992; Adams and Fitchett, 1992; Bouman, 1990; Adams and Vogel, 1986; Begashaw, 1978). However, rural financial markets in developing countries continued to be dominated by high proportion of users of informal finance. According to a World Bank report, over 80% of the world population rely on informal financial arrangements (WorldBank, 2001). This has led to a considerable recognition among development thinkers and practitioners that informal finance should not be considered anti-development in the broader rural financial system, although there are arguments that the informal financial sector cannot legitimately offer deposit services (Lamberte et al., 2006). More importantly, salient features of informal rural financial market can provide useful information to policymakers on how semiformal and formal markets can be developed to provide more demand-driven services (Lamberte et al., 2006).

Evidence elsewhere (e.g., Lamberte et al., 2006; Feder and Feeney, 1991; Carter and Olinto, 2003; Densiez, 1967) shows lack of access to large, long-term loan (or equity capital) by more successful farm households makes financing of additional land acquisitions difficult and in many cases impossible. This means that the necessary process of farm consolidation needed to achieve an optimal size for efficient crop production is constrained by poorly developed rural financial systems, with clearly negative implications for the rural economic growth. There is a critical need to expand the capacity of rural financial institutions to meet the need for short-, medium-, and long-term loans by nonpoor households and small and microenterprises in rural areas.

Informal finance providers continue to play a major role in developing rural credit markets (Lamberte et al., 2006; Adams and Fitchett, 1992). Early
theoreticians of microfinance focused on the “lumpy” cash-flow characteristics of agricultural activity, i.e., money being invested in a crop or an animal that is raised over a protracted period before the final product can be marketed. Therefore, the frequent periodic payments of interest and principal that were a central feature of successful micro-credit programs could not be supported by agricultural activity. This approach, however, ignored the fact that poor households have diversified sources of income and money is fungible.

In sum, the main thread running through the literature reviewed above is that financial market failure adversely affect the economic behaviour of farm households and there need to be corrective measures through government interventions but such interventions should not be distortive. That is, government should make structural reforms that liberalize the financial market and properly sequences the different components of the reform but such interventions should not be excess. In particular, governments need to consolidate efforts to develop effective legal, property rights, regulatory and financial laws that facilitate the development and smooth functioning of rural financial markets. The interventions should be aimed at reducing the adverse effects of the market failures on the performance of economic agents. In this process, issues such as land property rights, saving mobilization and institutional diversity are important to consider.
5. Summary of main results and discussion

This section summarises the motivation, methods used, major findings and policy implications of the four articles comprising this thesis. Since it is a concise summary, readers may need to refer to each article for further understanding. Although the articles aim at answering separate research questions, they are interrelated. Each article is based on the same dataset, and therefore, discusses issues closely related to each other. Article I, which tries to understand saving behaviour of farm households is related to Article II, which deals with sectoral choice of farm households in their borrowing behaviour. Article IV further considers credit and analyzes farm households’ demand for credit and its determinants. Article II and IV are directly related to credit whereas Article I serves as the basis for farm households’ capital accumulation, to which or beyond which a farm household may demand additional resources through credit. Article III considers an outcome of imperfect credit market - the credit constraint - and investigates its effect on farm households’ technical efficiency. The summary results of each article are presented separately below.

5.1 Article I: Farm households’ saving behaviour

This article was motivated by the observation that Sub-Saharan Africa’s slow economic growth correlates with low capital accumulation, which averaged 15% for about 30 years since 1970, compared to 23% for Southeast Asia and 35% for newly industrializing economies of Asian countries (Aryeety and Udry, 2000). In Ethiopia, the macro level saving rates in the past six decades showed declining trend, averaging 5.4% of GDP (Girma, 2004). Categorized by the political regimes, the average saving rates were 14% during 1960-1974 (Imperial Regime), 7% during 1974-1991 (Military Regime) and 3.6% during 1992-2003 (EPRDF Regime). However, these macro level observations might not mirror the situation at the microeconomic level. Hence, this article aimed at understanding saving behaviour at farm household level by analysing the type and extent of savings and identifying its determinants.

Using an agricultural household model (Taylor and Adelman, 2003; Singh et al., 1986; De Janvry et al., 1991) as a conceptual guide, farm household data were analyzed using descriptive statistics and censored regression (tobit) econometric model. Descriptive results show that 62% of the sample farm households had savings in physical and financial assets, of whom 57% had financial savings. However, 89% of farm households saved informally, i.e., outside of formal institutions. The main reasons for such a saving behaviour, as reported by the sample farm households, are perceived too small volume of savings to save at banks (52%), precautionary need for cash (17%) and low real return on bank deposits (8%). In an imperfect credit market, farm households are more likely to face borrowing constraints and this would lead to saving behaviour affected by feelings of uncertainty and hence a precautionary motive to save for countering the uncertainty (Leland, 1968). The econometric model aims to estimate the conditional mean saving and its determinants. Estimation results indicate that a typical farm
household had a conditional mean saving of about 37% of its farm income per annum. It also identified potential factors related to farm households’ ability, willingness and opportunities to save. Accordingly, it was found that farm households’ saving was significantly and positively affected by farm size, farm and non-farm incomes, farm experience, access to irrigation, investment motive and negatively by the schooling of farm household heads.

Financial intermediation requires resource mobilization efforts to create comprehensive financial services with adequate outreach to the majority of people and for the sustainability of the financial institutions (Gonzalez-Vega, 2003). The fact that large proportion of farm households who were able to save held their savings informally could be explained more by problems of incentives and opportunities to save in this way than by farmers’ ability to save, since a considerable proportion of farm households (about 62%) were in fact able to save. This calls for policies to improve the existing incentive structure and opportunities to channel the savings into deposits at formal institutions. Results suggest that financial institutions with easy access, low transaction costs, higher real returns on savings and convenient withdrawal of savings may provide incentives for those who informally hold financial assets to save them formally. This is desirable because mobilizing informal savings into formal institutions would expand the loanable capital base of lending institutions and improves resource allocation in the economy at large. This result is in line with the arguments in the literature that saving mobilization is one important factor in rural financial market development (Lamberte et al., 2006; Amel et al., 2004; Gonzalez-Vega, 2003; Roberts and Hannig, 1998; Deaton, 1992; Bencivenga and Smith, 1991; Braverman and Guash, 1986; Begashaw, 1978).

5.2 Article II: Credit sectoral choice of farm households

Rural credit market segmentation into different sectors has long been recognized in the literature on credit markets in developing countries (Adams, 1995; Braverman and Guash, 1986; Gonzalez-Vega, 2003; Guirkinger, 2005; Hoff and Stiglitz, 1990). However, little is known as to how farm households make borrowing choices under such segmentation and what factors influence their choices. Recently, official reports indicate that the formal credit sector in Ethiopia holds more than legally warranted reserves (NBE, 1996; IMF, 2006). Yet, many other studies show that farm households face credit constraints (Emana et al., 2005; Gobezie, 2005; Croppenstedt et al., 2003; Kassa, 2003; Gobezie, 2002; Mekonnen, 2002; Woldehanna and Oskam, 2001; Freeman et al., 1998). It is thus imperative to understand the reason why this is the case. One way to understand this is to analyse farm household borrowing behaviour, especially their sectoral choice. Motivated by this observed feature in the credit market, this article aims at analysing credit sectoral choice of farm households among formal, semiformal and informal credit sectors and identifying factors affecting their choice. Based on the same dataset as in Article I, Article II uses multinomial logit model, which is founded on the economic model of random utility maximisation (Luce, 1959; Manski and Lerman, 1977; McFadden, 2001), to estimate sectoral choice probabilities and their determinants.
Descriptive results indicate that more than half of the sample farm households (55%) borrowed from formal, semiformal or informal credit sectors, and of these borrowers, the largest proportion (about 50%) borrowed from the informal sector, followed by that from the formal sector (about 28%). The informal sector had the highest lending rate of interest (which was about 38.54% per annum on average but ranges up to 150%) and the formal sector had the least (11.12%). The fact that most farm households borrowed from the informal sector, although this sector charges more interest rate than other sectors, suggests that factors other than the interest rate, e.g. loan-processing time, type of loan, credit information and loan size had more weight in determining farm households’ borrowing behaviour from a particular sector. For example, it took about nine weeks to obtain a loan from the formal credit sector since application but one week in the semiformal sector and five weeks in the informal sectors. Timeliness of the loans is thus an important factor, especially for farm households since they are engaged in farming activities where input uses need to match the natural process in agricultural production.

Econometric results show that conditional choice probabilities were estimated at 0.3167, 0.1667, and 0.5167 for formal, semiformal and informal credit sectors, respectively. Thus, as evident in the observed data, the econometric estimation also confirms the dominance of the informal sector even though this sector exhibits the highest interest rates. The evidence that the majority of sample farm households use informal finance supports the World Bank report that over 80% of the world population rely on informal financial arrangements (WorldBank, 2001) and the continued role of informal finance providers (Lamberte et al., 2006). Furthermore, several household and loan characteristics significantly affected farm households’ sectoral choice. The formal sector was positively affected by gender (i.e., higher probability for male than for female), household labour, farm size, credit information and extension visit, and negatively by nonfarm income, dependency ratio and interest rate. The semiformal sector was positively affected by gender, household labour, credit information, repayment flexibility and cash/kind type of credit, and negatively by age, farm income, household saving, loan processing time, interest rate and lender-borrower distance. The informal sector was positively affected by age, religion, education, extension visit, repayment flexibility and cash/kind type of credit, and negatively by gender, nonfarm income, household saving, credit information, loan processing time and interest rate. The results suggest that sectoral choices are complex phenomena involving considerations of several factors and lending institutions need to take into account these complexities when devising financial products and instruments.

It was concluded that the informal credit sector is still the dominant sector in the Ethiopian rural financial system despite the reform’s hoped-for expansion of formal credit to the rural areas. More importantly, factors other than the interest rate significantly affected farm households’ sectoral choice. Thus, lending policies and instruments of formal and semiformal financial sectors need to be more compatible with farm households’ borrowing characteristics.
5.3 Article III: Influence of credit constraints on technical efficiency

Farm households are heterogeneous in resource endowments and so are their technology choice and risk aversion behaviours. Technology adoption and risk behaviour of farm households are likely to affect production efficiency. However, previous studies gave little emphasis to the effect of credit constraints in production efficiency. Using the same dataset previously mentioned, this study first tested the difference in credit constraint status of the farm households and then estimated and compared technical efficiency of credit-constrained and unconstrained farm households. Furthermore, it identified additional inefficiency factors, which could affect technical efficiency of farm households.

Descriptive results indicate that not only were the majority of farm households in the study areas credit constrained, but also farm households differed significantly in their credit-constraint status. Econometric estimates showed that credit constraint affected technical efficiency of farm households and credit-constrained farm households had mean technical efficiency that was less than that of the credit-unconstrained farm households by about 12%. This result is closely related to previous studies by Blancard et al. (2006) and Latruffe (2004). In addition, analysis of factors contributing to technical inefficiency revealed that education, land fragmentation and loan size, among others, had significant effects. The fact that lower technical efficiency of the credit-constrained farm households was reflected in their inability to procure the necessary productive inputs relates to previous studies in Ethiopia e.g. by Croppenstedt et al. (2003), where it was reported that credit constraint limited adoption of improved technologies. The positive correlation between loan size and technical efficiency is in line with the literature which argues that indebted farm households face repayment obligations, which encourages them increase efforts and limit waste of factors of production (Latruffe, 2004), but differs in the sense that the loan size needs to be adequate to enable adoption of more productive technologies.

Given the largest proportion of the credit-constrained farm households, the 12% technical efficiency gap implies considerable loss in output in the study areas. Assuming that such gap is not unique to the study areas, at the aggregate, this would be costly for a country that often faces food insecurity problem. Moreover, the average technical efficiencies of both the credit-constrained and unconstrained groups were low. Thus, technical efficiency of the farm households in general and more of the credit-constrained farm households in particular need to be improved. This requires consolidation of credit, education and land policies that can improve the existing situation.

5.4 Article IV: Farm households' demand for credit

In Ethiopia, private financial sector re-entered the credit market following the financial sector reform of the 1990s, which overhauled the financial system previously nationalized under the Military Regime. Assuming that the reform would improve credit supply conditions to the farm households, Article IV aimed at estimating farm households’ demand for credit and identifying factors affecting
their demand. The primary source of data for this article was the same dataset used in the other articles. Moreover, published and unpublished secondary sources were reviewed to understand the credit supply in Ethiopia in general, and in the study areas in particular. Both descriptive statistics and censored regression were used for data analysis.

Secondary sources indicate that the share of private banks in the formal credit market has increased from less than 10% in 1999/2000 to about 30% in 2005/2006 as a result of the 1990s economic reform program (NBE, 2007) but with little expansion to the rural areas. Formal credit sector provided loans to farm households for only productive purpose irrespective of the farm households’ demand for consumption credit. Credit rationing was a prevalent phenomenon in credit supply of the formal credit sector to farm households in the study areas. Although farm households had credit demand for consumption purposes, as expected, this could not be obtained from the formal sector. However, farm households reported obtaining loans for such purposes from semiformal or informal sources at significantly higher interest rates. This again confirmed the widely observed role of informal finance in developing countries (Lamberte et al., 2006; Adams and Fitchett, 1992). The fact that the farm households borrowed from the informal sources at higher interest rates suggests that there is an extensive margin for the formal sector to expand credit supply to the farm households by possibly increasing the lending interest rate by way of a competition with the non-formal sector.

Econometric estimation revealed that demand for credit of a typical farm household was about 2.3% of its farm income. This corresponds with seasonal liquidity constraint a farm household faces to finance its costs of production inputs, medical care and children’s education. Several factors significantly affected credit demand of farm households. Among others, investment in children’s education and medical care positively affected farm household demand for credit. Given that such costs are not currently public financed, each household faces them privately, and this is likely to be affected negatively by their liquidity constraints. Since the health and education of members of a farm household directly or indirectly affect their productive capacity, it is evident that credit supply irresponsible to farm households’ credit demand for education and health maintenance fails to account for complementarity of production and consumption at farm household level. Therefore, formal credit sector’s financial products and instruments need to address consumption credit demand compatible with the farm households ability and willing to repay the debt. Otherwise, public policy needs to lower costs related to education and health care for the farm households, as they affect their productive capacities.
6. Conclusions and policy implications

As evident in Article I, about 62% of the farm households had savings in financial and physical assets but almost all farm households (about 90%) had savings held informally. This was explained more by problems of incentives and opportunities to save than by their ability to save. It suggests that financial institutions with easy access, low transaction costs, higher real returns on savings and convenient withdrawal of savings may provide incentives for those who hold financial savings informally to channel their savings into the formal institutions. Mobilizing informal savings into formal institutions can build the institutions’ loanable capital base and improve resource allocation in the economy.

For both saving and credit, the informal credit sector remained dominant in the credit sector of Ethiopia in general and of the study area in particular. This is contrary to the reform’s hoped-for expansion of formal credit to rural areas. Evidence also shows that factors other than the interest rate, i.e., loan-processing time, type of loan, credit information and loan size, significantly affect farm households’ sectoral choice. This suggests that lending policies and instruments of the formal and semiformal financial sectors need to be compatible with borrowing behaviour of the farm households.

On the supply side of the credit market, the majority of farm households are credit constrained. However, evidence shows that farm households differ significantly in their credit constraint status. Article III shows that credit constraint affected technical efficiency of farm households and there was a gap of 12% in technical efficiency between credit-constrained and -unconstrained farm households. Given the largest proportion of credit-constrained farm households, the observed technical efficiency gap is a considerable loss in output. Since the average technical efficiency scores of both groups are low, the technical efficiencies of all farmers need to be improved. Moreover, the efficiency gap between the credit-constrained and credit-unconstrained farm households needs to be narrowed. For this, credit, land and education policies need to be reconsidered.

Much empirical evidence suggests that underdeveloped rural financial market in developing countries hinder economic growth and development. One of the reasons for low level of rural financial market development in these countries is the presumption that farmers are too poor to save and that they produce little marketable surplus. In Article I, it was found that the farm households, who are generally smallholder farmers, were able to save both in physical and financial assets, no matter how small the assets, which disproves the prior presumption. More importantly, the policy-relevant evidence is the fact that the farm households held their savings informally mainly due to problems of incentives and opportunities. This evidence suggests that, if rural financial markets are developed in such a way that savers’ costs are reduced and returns improved to yield sufficient net benefits, then it is possible to tap these undermobilized resources for a better resource reallocation in the economy. This, in turn, can increase the capital base of the formal lending institutions and enable them to expand financial services to rural areas. If formal financial institutions expand to the rural areas, this is likely to create
competition in the financial market, lowering costs of saving and borrowing by reaching out to even the lowest income brackets of the rural communities. In this way, even the poor can save and contribute to resource mobilization, and the financial institutions would deepen in their effectiveness and efficiency of financial services to become sustainable.

As the results in Article II and IV show, the farm households borrow from the informal credit sector at significantly higher interest rates, particularly for consumption purposes. The formal financial institutions ration loans to rural borrowers because they lack the conventional collateral. These facts suggest two implications for rural financial market development. Firstly, the fact that the farm households borrow at higher interest rates offers a possibility for the formal sector to expand financial services by raising its interest rates competitively with the informal credit sector since there is effective demand for credit by the farm households. Through such expansion, the formal sector would locate branches appropriately for service provision, reach out to many rural borrowers and increase the total loan volume. With increased loan volume, the unit cost of lending would reduce, making the formal sector more profitable. Secondly, the formal sector needs to relax the restriction of lending only for productive purpose as far as the borrowers are creditworthy. This also means that more comprehensive assessment of the creditworthiness of farm households and rural entrepreneurs, including those credit purposes affecting labour productivity (such as education and health) are needed.

As indicated earlier, theory offers three possible approaches to the relationship between credit and technical efficiency, based on the “free cash-flow” approach, agency theory and credit evaluation approach. The evidence in Article III of this study suggests that if loans are extended to farmers to the extent that sufficiently tackles credit constraints of borrowers, this would positively affect their technical efficiency. In turn, this would allow production of more outputs to generate marketable surplus that would increase repayment capacities of borrowers. Increase in repayment capacity is likely to motivate lenders to extend credit to the farm households. This evidence is in line with the first and third approaches described above.

In relation to land property rights, one of the reasons for the inability of farm households to borrow from the formal sector and for the formal sector’s reluctance in participating in rural credit supply is farm households’ lack of acceptable collateral guaranteeing the loans. However, evidence in many other developing countries and in almost all developed countries shows that a farmland is an important asset, which determines farm households’ borrowing capacity. In Ethiopia, farm households currently have only usufruct rights, not ownership rights. With this limited property rights, it is not possible to use it as a collateral for obtaining credit. Therefore, it calls for consideration of the existing land property rights laws that would allow farm households to be able to use land for collateral purpose to obtain credit.
7. Contributions of the thesis

The contribution of this thesis to the category of literature it addresses is mainly empirical. That is, although the theoretical frameworks used in all the articles are in essence not new to the literature, studies showing their applications in developing countries in general and to the smallholder farm households of Ethiopia are generally new. Hence, by taking the different theoretical concepts used in the articles to empirical tests, this study has tried to fill the empirical void at least for Ethiopia.

Article I considers a farm household model, where production and consumption decisions are inseparable due to imperfection in the credit market and derived conditions for possible farm households’ saving behaviour, by disaggregating their savings into physical and financial assets. It further investigated potential factors affecting saving behaviours of farm households under imperfect rural financial market conditions and found that although the farm households had some ability to save, they face problems of incentives and opportunities to channel their savings through formal financial institutions. The fact that most farm households were able to save not only falsifies the widely held notion that “the poor are too poor to save”, but also supports the idea that if appropriate incentive mechanisms are put in place, these savings can be mobilized for better resource allocation.

As much as saving decisions are behavioural in nature, so are credit sectoral choices of borrowers. The behavioural nature is even highly pronounced under imperfect market conditions, where access and participation in credit market are not plain grounds for most of the farm households. Whereas previous literature considers credit market participation of borrowers from different dimensions, empirical evidence is limited in analysing credit sectoral choice of borrowers as affected by behavioural factors. Article II, therefore, contributes to this gap by showing several factors, especially behavioural ones, which affect farm households’ choice of a particular credit sector under imperfect credit market conditions.

The presence of a credit constraint faced by farm households is not new to the literature, both theoretically and empirically. However, its influence on technical efficiency of especially farm households in developing countries is not widely investigated. Moreover, previous studies of production efficiency measurement addressed the problem of credit constraint as a dummy variable, which captures only whether or not a farm household has access to credit or has taken a loan. Clearly, this way of addressing the credit problem does not capture the issue of whether or not the farm household would remain credit constrained after participating in the credit market. Therefore, by using direct elicitation approach to capture credit constraint of farm households, Article III contributes to the body of literature by showing the effect of credit constraint on technical efficiency of credit farm households in the context of developing countries.

Article IV contributes to the literature on credit demand by bringing insights in which farm households’ demand for production and consumption credit are interdependent. That is, farm households’ demand for credit for the purpose of covering expenditure on children’s education and health, which are often
considered ‘consumption’ activities also affect farm production through labour supply effects. It shows that credit supply that targets only ‘production’ loans fails to address the interdependence between production and consumption activities at farm household level.

In general, the study shows how an imperfect financial market affects farm household behaviour in terms of saving, credit demand, credit sectoral choice, and technical efficiency. Finally, attention is drawn to an excerpt from Muhammad Yunus’ 2006 Nobel Peace Prize lecture. He stated: “… we create what we want. If we firmly believe that poverty is unacceptable to us, and that it should not belong to a civilized society, we would have built appropriate institutions and policies to create a poverty-free world.” This is related to the previous quotation from Schultz’s 1979 Nobel Prize lecture quoted earlier. It is a fact that one in five of the world’s population lives in abject poverty with a per capita income of less than a dollar a day (WorldBank, 2006). At least two-thirds of these people live in rural areas and in the poorest countries where the share is as high as 90% for some countries (e.g. 40% for Ethiopia). For all these people, what happens to the rural economy is vitally important. Yunus suggests design and development of appropriate institutions, which are aimed at eradicating poverty. Schultz argues that we need to understand the economics of being poor, which can serve as a component of the design framework of the institutions to be built. In my view, Schultz points to the fact that much needs to be understood to fight poverty and Yunus offers the institutional design towards the solution. I think that by studying the microeconomic behaviour of farm households in poor countries, we are able to understand what has kept the poor poor. In this connection, this thesis argues that one such problem is the imperfection in rural financial market, which adversely affects farm households’ saving, borrowing and production efficiency. Therefore, to understand the strengths, weaknesses and opportunities of the existing market and non-market institutions and to devise new better ones, much remains to be investigated.
8. Suggestions for further research

A natural extension of a cross-sectional research is to give it a time dimension in order to assess the nature of the variables over time. This will allow us to understand seasonal variations in a year, variation between years and changes in trends due to environmental factors in the variables measured. Accordingly, saving behaviour of farm households is likely to change over time due to changes in the demographic and socioeconomic circumstances of the farm households and in the environments, which may affect farm households' abilities, incentives and opportunities to save. Credit demand, sectoral choice and technical efficiency are also dynamic in nature. Therefore, we will have better understanding if such studies are followed up by bringing in the time dimension into their measurements and estimations. The current study did not use longitudinal and/or panel data, due to time and budget constraints to collect such type of data. Therefore, further research efforts are required to generate a comprehensive panel dataset and use panel data econometrics to study further the fixed and random effects in the estimations.

Another area of consideration emanates from the fact that Ethiopia is diverse in terms of agroecological, socioeconomic, cultural and religious features. Due to this heterogeneity, there cannot be a specific policy recommendation that can fit all areas and circumstances. Since diverse environments are not expected to fit to a single policy recommendation, a feasible direction is to try to devise relevant policies in tune with the diversity. In this connection, a study limited to a certain area might not be relevant for other areas. Therefore, another possible extension of this study is to try to replicate it in other socioeconomic and agroecological settings of the country to further understand and explain variations and similarities among different locations. This will enrich the results obtained in this study and can improve policy recommendations.

Finally, due to data shortage the supply side of the financial market, particularly the semiformal and informal financial sector, was not adequately studied in this thesis. Therefore, further research is necessary to understand in detail the nature of supply conditions and existing transactions.
References


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Hussien Hamda Komicha,
SAVING BEHAVIOURS OF FARM HOUSEHOLDS UNDER IMPERFECT RURAL CREDIT MARKETS: THE CASE OF SOUTHEASTERN ETHIOPIA

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Abstract

This paper starts with a theoretical farm household saving model deriving optimality conditions in terms of physical and financial assets under imperfect rural credit market settings. It then analyzes farm households' saving portfolios and estimates factors affecting farm households' saving behaviours using descriptive and econometric tools, based on farm household survey data from two districts in South-eastern Ethiopia. Descriptive results show that 62% of the farm households had positive savings, and of these, about 57% had financial savings. Majority of farm households deposited their savings outside formal financial institutions (89%), having attributed mainly to their volume of savings perceived too small to formally save (52%), precautionary need for holding cash (17%) and low real returns on bank deposits (8%). Perception of small volumes of savings, which accounted for the overwhelming majority, was more likely to be linked to real costs faced by the farm households to make such deposits in formal financial institutions, which were not easily accessible to the farm households. The importance of precautionary need for cash reflects farm households' borrowing constraints, due to their limited access to formal sector credit. The econometric model shows that a farm household had a conditional mean annual saving of Birr 4361. The saving behaviour of farm households was significantly (p < 0.1) affected by farm size, farm and non-farm incomes, farm experience, access to irrigation, investment motive and schooling of farm households, which mirror their capacity, incentive and opportunities to save. The results suggest that savings can be mobilized through formal financial institutions if proper incentives are designed to attract savers which, in turn, may improve resource allocation and enhance development endeavours in the economy.

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Introduction

Sub-Saharan Africa's slow growth relative to other developing regions of Asia and Latin America is often correlated with slow capital accumulation, mainly attributed to low saving rates (World Bank, 1994). For example, gross domestic savings for the entire Sub-Saharan Africa (SSA) averaged only 8% of GDP in the 1980s, compared to 23% for Southeast Asia and 35% in the Newly Industrialized Economies of Korea, Hong Kong, China, Singapore and Taipei China. The saving rates had declined over the last three decades in most countries of SSA, not exceeding 15% of GDP (Aryeety and Udry, 2000). For Ethiopia, the average domestic saving rate was 5.4% of the GDP for the period 1963-2003, with a declining trend of 14, 7 and 3.6 percents of the GDP during the periods 1960-74, 1975-91, and 1992-2003, respectively (Girma, 2004). These periods span over three political regimes of different economic policies: a market economy during the first and the third periods and a socialist command economy during the second period. The relatively higher saving rate in the first period was likely due to favourable market-based policies at the time. However, the shift from the second to the third period did not show positive growth in saving rates; it continued declining instead. As this trend is of a macroeconomic nature, one would like to know its reflection at microeconomic level, and, more precisely, at farm household level. This is mainly because aggregate figures do not effectively explain much about microeconomic behaviours (Browning and Lusardi, 1996). Hence, with the aim of bridging this empirical gap, this paper attempts to explore the nature of savings at farm household level.

The central question in savings mobilization literature has been whether rural households are able to save in the form of financial
assets, and are also willing to entrust their savings in the formal financial institutions. A recent study by Emana et al., (2005) has documented saving and lending practices in four regions of Ethiopia and identified the dominance of informal finance over the formal ones. Several other studies (e.g., Bouman, 1984; Aryeety, 1992; Gurgand et al., 1996; Elhiraika 1996; Steel et al., 1997; Wright, 1999) also show similar evidences elsewhere in the developing world. Savings in these forms of institutions typically reflect prevalence of incomplete and fragmented financial markets in the economies considered. Such savings are rarely mobilized into larger scales beyond members of the informal institutions and hence fail to mitigate covariate risks affecting all members of the institutions (Aryeety and Udry, 2000).

Since the beginning of the 1990s, Ethiopia has adopted a World Bank/IMF-sponsored economic reform programme and laid out a development strategy known as Agricultural Development-Led Industrialization (ADLI). In this strategy, agricultural development is aimed at raising productivity. Subsequently, several other economic reforms were undertaken of which financial reform was one. As part of this reform, currency was devalued, and as a result, input prices rose in 1993. The price rise led to a reduced use of chemical fertilizers by smallholder farmers in the ensuing years, contrary to the direction envisaged in the development (ADLI) strategy. Thus, subsidies of agricultural input prices in the order of 15%, 20%, 30% and 20% were introduced in 1993, 1994, 1995 and 1996, respectively, but ultimately removed in 1997 (MEDAC, 1999). Again after the removal of the subsidies, farm households continued to face financial constraints (EEA, 2004).

Part of the problem was that formal financial institutions were not adequately streamlined to play vital roles in agricultural finance. On the
one hand, they have been few in number, limited in depth and breadth of services and skewed against rural areas and smallholder farmers. For example, the Commercial Bank of Ethiopia, with its 172 branches during the reform period, covered only about 21% of the total districts of the country and the Development Bank of Ethiopia (DBE), with only 35 branches (Mulat et al., 1998), covered much less. On the other hand, and more importantly, these institutions have been less accessible to smallholder farmers, who constitute the major segment of the whole population, as they lack conventional collaterals. For instance, the farmers have no land property rights under the current Ethiopian law, and thus cannot use land as collateral to secure credit from formal financial institutions.

Cognizant of the above condition, the financial sector has been further reformed to establish microfinance institutions, which could advance credit to smallholder farmers without requiring physical collateral. In fact, these institutions use group collateral based on joint liability of co-borrowers. Accordingly, about 26 microfinance institutions have been established so far in the country to reach smallholder farmers with limited access to credit from conventional banks. Moreover, the Commercial Bank of Ethiopia began taking part in agricultural inputs credit service through a mechanism of regional governments’ institutional loan guarantee, which enables financial institutions to reclaim a default by borrowers directly from the regional governments. Regional governments enforce loan repayments with the help of administrative authorities. Thus, one may expect that such a scheme would relax the borrowing constraints faced by smallholder farmers. However, empirical evidences are lacking and little is known about the effect of the policy change at farm household level. Hence, this study attempts to bridge the empirical gap by analyzing the nature of farm household saving as related to farm production, consumption and
investment behaviours of farm households. The specific objectives of the study are to identify and explain (i) types and extent of savings by farm households, given the imperfect rural credit market, and (ii) demographic, socioeconomic and institutional factors affecting farm households’ saving behaviours.

The paper used data collected from a farm household survey conducted in Merti and Adamitullu-Jido-Kombolcha districts in southeastern Ethiopia. The major economic activities of the farm households in the study areas are based on agriculture, which is susceptible to shocks of weather and market conditions. Smallholder farm households were the focus of the study to capture the nature of their financial constraints (both borrowing and saving). The remainder of the paper is organized as follows. Theoretical model of farm household saving, under imperfect credit market condition, is presented in the next section, followed by the empirical model employed and description of data used in the model. It subsequently presents and discusses the descriptive and econometric results. Finally, conclusions are drawn and some policy implications are suggested.

Theoretical Model of Farm Household Saving

A standard household model assumes the existence of complete factor and product markets and separable production and consumption decisions of a farm household. However, in low-income economies, these assumptions are often implausible since markets are incomplete (Morduch, 1995) and farm household production and consumption decisions are hardly separable (de Janvry et al., 1991). The inseparability of production and consumption decisions also affects household saving behaviours. Hence, it is imperative to understand
household saving behaviours within the framework of farm household model\textsuperscript{1}. In this model, a farm household acts both as a producer and a consumer. The decisions resulting from such models are that the producer side of the household maximizes profits, given market and shadow prices, while the consumer side of the household maximizes utility given market and shadow prices (Taylor and Adelman, 2003). The farm household, therefore, chooses production and consumption plans that are consistent with its objectives. In other words, quantities produced plus initial endowments match consumption in the case of non-traded goods and consumption expenditure on traded goods is generated by the sale of outputs or endowments.

Farm households allocate resources over time both for production and consumption. This requires saving in a current period to provide for next-period consumption or investment (Deaton, 1997). Household saving can be defined as a net change in equity between periods including changes in monetary and non-monetary assets and adjustments for changes in debt (Zeller \textit{et al.}, 1997). In the literature there are two common ways of measuring savings, i.e., income minus consumption and first difference of wealth (Browning and Lusardi, 1996). Household saving may be initiated by one or more motives\textsuperscript{2} and households may evaluate different forms of savings in terms of security, liquidity and economic return. Decisions to hold assets intertemporally also depend on the degree of risk exposure and risk-bearing abilities of households, and the nature of input and output

\textsuperscript{1}Early emphasis in farm household model was on price policy analysis (Singh \textit{et al.}, 1986) but subsequent uses included applications in other areas such as off-farm labour supply, technology policy, nutrition policy, income distribution, family planning and savings. Recent extensions of the basic model by de Janvry \textit{et al.} (1991) explicitly include a missing market case.

\textsuperscript{2}Keynes (1936) lists several saving motives: precautionary, life cycle, intertemporal substitution, improvement, independence, enterprise, bequest, avarice, and down payment motives. Browning and Lusardi (1996) extensively formalized and discussed how the different models encompass one or the other motives.
markets. Moreover, economic theorists agree that income and/or wealth is the main driving force behind consumption and saving, though they disagree on the type of income to be considered. The Keynesians use current/absolute income; followers of Friedman use permanent income; in Modigliani, permanent income over a life cycle of a household is employed, while in Duesenberry focus is placed on relative income (Schmidt-Hebbel and Severn, 1996).

However, empirical applications of many of these theories and their relevance to specific circumstances are limited. For instance, Deaton (1991) noted that permanent income hypothesis and lifecycle models abstract from borrowing constraints and the often-used quadratic utility function rules out precautionary savings. Hence, Deaton (1997) considers extensions where households have a precautionary motive for saving as they face liquidity constraints. He specifically suggests a saving model for poor households, which takes into account borrowing constraints and precautionary saving motives (Deaton, 1997:357). Accordingly, a farm household may follow a utility function that can be expressed as,

$$ U = E_t \sum_{t=0}^{T} \beta (1 + r_t) v_t( c_t ) $$

(1)

Where, $c_t$ is consumption in period $t$, $T$ being the time-horizon, $v_t(.)$ is the instantaneous sub-utility function for period $t$, $E_t$ is the expectation conditional on information at time $t$, $\beta \equiv (1/(1+\delta))^t$, $\delta$ being rate of time preference and $r_t$ is the real rate of interest. The sub-utility changes over time since the structure of households also changes over the age of the heads of the households.
Suppose households can save two types of assets: a financial asset $s_f$ and a physical asset $s_p$. The financial asset generates interest or rental income, whereas the productive asset is directly employed in the production process in addition to household labour and land resources. In period $t$, the household allocates its available resources, the value of current assets $A_t$ and an exogenous (if any) income $y_t$, between consumption $c_t$, $s_f$ and $s_p$:

$$c_t + s_f + s_p = A_t + y_t$$

(2)

The current value of assets is generated through investment and production choices during previous period, $t-1$, as follows:

$$A_t = (1 + r_f(\eta_t))s_{f,t-1} + (1 + r_p(s_{p,t-1}, z_t))s_{p,t-1}$$

(3)

Where, $r_f$ and $r_p$ are the rates of return on $s_f$ and $s_p$. Here, returns on the productive assets depend on the production technology in the production process, which, in turn, depends on household characteristics ($H_t$) such as family size, levels of education, and assets not exchanged in the market. $H_t$ may include household-specific random shocks to asset returns in the production process. The returns also depend on random shocks not specific to the household, $\eta_t$. Let $Z_t \equiv (H_t, \eta_t)$. Financial assets derive returns depending on market factors and random shocks, captured by $\eta_t$, $r_f(\eta_t)$.

Farm households maximize the objective in Equation (1), subject to the constraints in equations (2) and (3). The value function of the problem can be written as
$V_t(A_t) = \max_{s_{t+1}} v_t(A_t + y_t - s_{pt} - s_{pt})$

$$+ E_t v_{t+1}((-1 + r_f(\eta_{t+1}))s_{pt} + (1 + r_p(s_{pt}, z_{t+1}))s_{pt})$$

The first order condition with respect to the asset used in production will be

$$v'(c_t) = E_t(1 + r_p(s_{pt}, z_{t+1}) + \frac{\partial r_p(s_{pt}, z_{t+1})}{\partial s_{pt}} s_{pt}) v'_{t+1}(A_{t+1})$$

Using the well-known envelope property, (5) can be rewritten as

$$v'(c_t) = E_t(1 + r_p(s_{pt}, z_{t+1}) + \frac{\partial r_p(s_{pt}, z_{t+1})}{\partial s_{pt}} s_{pt}) v'_{t+1}(c_{t+1})$$

Equation (5) follows from the use of asset holdings in production, which is chosen optimally. Increments to holding of a productive asset result in diminishing returns as fixed household factors are spread more sparsely across the productive asset. If the farm households are risk neutral and have complete access to insurance markets, which of course do not hold in our study areas, the result in (5) implies

$$v'(c_t) = \beta v'_{t+1}(c_{t+1})$$

for any $c_t$ and $c_{t+1}$

and, (5') now can be simplified to:

$$\beta - 1 = E_t(r_p(s_{pt}, z_{t+1}) + \frac{\partial r_p(s_{pt}, z_{t+1})}{\partial s_{pt}} s_{pt})$$
The distribution of the return to the financial asset does not vary across households. If we assume constant mean, \( \bar{\bar{\bar{\gamma}}} \), over time, financial market equilibrium requires that \( 1 + \bar{\bar{\bar{\gamma}}} = \beta \) and in this case (7) becomes,

\[
\bar{r}_f = E_t( r_p( s_{pt}, z_{t+1} ) ) + \frac{\partial r_p( s_{pt}, z_{t+1} )}{\partial s_{pt}} s_{pt}
\]

According to Equation (8), all the assets held by farm households in the economy earn an expected marginal return equal to that which can be obtained in the financial market. However, we know that this only holds true under perfect market conditions, again which fails in our case.

On the production side of the farm household, output depends on the vector of inputs \( x \) purchased on the market at a price \( p_x \) and on the \( s_p \) asset. In this case, we can define,

\[
\pi( s_{pt} ) = E_t( r_p( s_{pt}, z_{t+1} ) ) s_{pt} = \max_{x_{t+1}} E_x F(x_{t+1}; s_{pt}, z_{t+1}) - p_{x_{t+1}} x_{t+1}
\]

Where, \( F(x; s, z) \) is increasing and strictly concave in \( (x, s) \) for all \( z \). \( s_{pt} \) will be chosen from (8) so that,

\[
\bar{r}_f = E_t( r_p( s_{pt}, z_{t+1} ) ) + \frac{\partial r_p( s_{pt}, z_{t+1} )}{\partial s_{pt}} s_{pt} = \pi'( s_{pt} )
\]
Saving Behaviours of Farm Households...

Since \( F(x; s, z) \) is strictly concave, \( \Pi'(s_{mt}) \) will be strictly decreasing in \( s_{mt} \). This leads to a unique value \( s^*_{mt} \), which solves (10). It is also possible to see by total differentiation of (10) that 

\[
\frac{ds^*_{mt}}{d\bar{r}} < 0 \quad \text{and} \quad \frac{ds^*_{mt}}{dA} = 0,
\]

where the latter means that household saving of the physical asset is independent of household wealth. Demand for that asset is determined entirely by the marginal productivity of the asset in the production process and the return on alternative assets.

Farm households in developing countries, in general, and in the study areas, in particular, face borrowing constraints, incomplete labour market, and risks in yields and prices in agricultural production and marketing. In this situation, farm households take precautionary actions to maintain some liquidity by holding cash at home, and livestock and/or crop outputs that can easily be liquidated as need arises.

A way to account for, for example, borrowing constraint, is by imposing non-negativity restriction on the assets in the first period, i.e., \( s_n \geq 0 \), to protect second period downturn. The value function in (4) will now be modified as,

\[
V_t(A_t) = \max_{s_t} v_t(A_t + y_t - s_t - s_{pt})
\]

\[
+ E V_{t+1}((1 + r_f(s_{n+1}))s_{ft} + (1 + r_p(s_{pt}, z_{t+1}))s_{pt} + \sum \lambda_t s_t)
\]

(11)

Where, \( \lambda_t \) is the Lagrange multiplier for the borrowing constraint, which restrains the assets to non-negative values.

The first order condition for the productive asset will now become,
Where, complementary slackness condition holds between $X_{it}$ and $s_{it}$. One case is where the return to the productive asset is so high that for a household with total wealth $A_{it}$,

$$
\bar{r}_f < E_i (r_{it} (s_{it}, z_{t+1})) + E_i \left( \frac{\partial r_{it} (s_{it}, z_{t+1})}{\partial s_{it}} \right) A_{it}
$$

(13)

This means that if the household allocates all its wealth to the productive asset, the return from that asset will be larger than the return to the financial asset. Without liquidity constraints, this household would simply borrow financial assets to accumulate more of the directly productive assets until it accumulates enough $s_{it}$ to derive down the expected return from that productive asset to $\bar{r}_f$. If such borrowing is not possible, then the situation in Equation (12) becomes apparent. For this household, $\lambda_{it} = 0$, that is, the liquidity constraint on the productive asset is not binding. However, $\lambda_{it} > 0$ because $s_{it} = 0$. Then the household’s portfolio will be in equilibrium with

$$
\bar{r}_f < E_i \pi' (A_{it})
$$

(14)

Thus, for households with sufficiently small wealth, holdings of directly productive assets will be increasing in total wealth, and financial asset holdings will be zero. Holdings of directly productive
assets for households with sufficient wealth will be fixed due to technical efficiencies.

In deciding whether to save and transfer income to the next period or consume in the current period, Equation (6) requires that the individual needs to equalize marginal utility of consumption across time as

\[ v'(c_t) = \beta(1 + r_t)E_t v'(c_{t+1}) \]  \hspace{1cm} (15)

This Euler Equation (15) characterizes decision to postpone consumption to a next period. The parameters \( \delta, r, E, \) and other household characteristics \( (H_t) \) influence the decision to save part of the current income for future consumption. Interest income on deposits, as an incentive for being patient, requires the household to compare the benefits with the costs of its patience. If \( r > \delta \), so that the rewards for waiting are sufficiently large to overcome impatience, the marginal utility of consumption will be falling with age, and consumption will be rising. Conversely, if impatience overcomes the incentives to wait, marginal utility will be rising, and consumption falls (Deaton, 1997:360).

The marginal utility of consumption can also be thought of as determining a shadow price of consumption. Since there is diminishing marginal utility of consumption, this price is higher when consumption is low. For example, for farm households, additional consumption is more urgent in bad seasons than in good seasons. Therefore, marginal utility of consumption rises more rapidly when consumption is low. At subsistence, this tends to infinity and the marginal utility of consumption function becomes strictly convex.
Convexity of marginal utility of consumption is related to liquidity constraints and precautionary saving motive (Leland, 1968). Suppose that next season’s consumption becomes more uncertain, due to, say, shortage of rainfall adversely affecting agricultural yields in such a way that its average remains the same but its variance becomes larger. Because the marginal utility function is convex, the increase in the variance will increase its expected future value, and so the current marginal utility of consumption must increase to preserve the equality in Equation (15) in both periods. However, since the marginal utility is decreasing, current consumption will fall and saving will increase. This also implies that an increase in uncertainty about consumption in future period will increase current saving by decreasing current period consumption. When the marginal utility of the consumption function is convex, increases in future uncertainty lead to current savings. Hence, precautionary saving motive is primarily to protect consumption from annual or seasonal income fluctuations (Deaton, 1989). Both precautionary saving motive and liquidity constraints result in household saving in the current period.

In the empirical part of this paper, we look for evidences on farm household saving portfolios and behaviours using survey data in view of the preceding theoretical arguments. We see from descriptive results that farm households hold both financial and physical assets. In the econometric analysis we identify factors determining saving behaviours of the farm households. The econometric model is specified in the next section.
Empirical model
Specification of econometric model

As defined in the previous section, farm household saving is a net change in equity between periods, measured in terms of financial and non-financial assets. Several studies (e.g., Lee and Yasuyuki, 2005; Park, 2005; Fafchamps et al., 1998; Deaton, 1997; Zeller et al., 1997; Alderman, 1996; Udry, 1995; Townsend, 1995; Rosenzweig and Wolpin, 1993; Paxson, 1992) suggest that household saving decisions depend on several socioeconomic and demographic factors. However, specific factors vary under different circumstances. In this study, we hypothesize that farm household saving \( S_i \) depends on their ability \( (\Theta_i) \), willingness \( (\Psi_i) \) and opportunity \( (\Omega_i) \) to save as,

\[
S_i = f(\Theta_i, \Psi_i, \Omega_i)
\]  

(16)

Ability to save \( (\Theta_i) \) refers to the capacity of the household to have wealth and income in excess of the unavoidable consumption demand in the current period. This is expected to be affected by farm size \( (FS_i) \), farm asset \( (FA_i) \), farm income \( (FI_i) \), non-farm income \( (Ni_i) \), household labor force \( (LF_i) \), and dependency ratio \( (DR_i) \).

Farm household's willingness to save \( (\Psi_i) \) relates to incentives motivating the farm household to save in the current period. This in turn depends on the return on savings in terms of interest rate if deposited \( (IN_i) \), farm experience of the household head \( (FE_i) \) and level of education of household head \( (ED_i) \).

The opportunity of the household to save \( (\Omega_i) \) refers to the external factors affecting the opportunity to generate income. This includes access to irrigation facilities \( (IR_i) \), availability of investment
alternatives for the farm household \((IV_i)\), and proximity of the household to a formal financial institution \((DF_i)\).

Taking into account the error term \((u_i)\) and explicitly rewriting Equation (16), we specify the following reduced form estimable equation.

\[
S_i = f(FS_i, FA_i, FI_i, NI_i, LF_i, DR_i, IN_i, FE_i, ED_i, IR_i, IV_i, DF_i; u_i)
\] (17)

Econometric analysis using survey microdata is generally plagued by problem of data misreporting by survey respondents. For example, Deaton and Irish (1984), Maki and Nishiyama (1996), Klein (1988) and Erard (1997) observed such problems in their analyses. Deaton (1997: 8-40) specifically indicated that household surveys in developing countries frequently record dissaving by substantial fractions of households, partly due to underestimation of income relative to consumption. As our data come from survey responses and since household saving questions are sensitive in nature, these types of errors are also expected in our data. For a farm household reporting no saving in one year period, saving takes zero value but the respondent provides other useful information that should not be truncated. Hence, to account for such data feature in estimation, it is appropriate to use censored regression (or Tobit) model (Tobin, 1958; Maddala, 1983; Amemiya, 1985)\(^3\).

Observed saving \(S_i\) is constrained from below at zero due to either misreporting or true zero or negative values of saving (or dissaving).

\(^3\) This makes use of the information on those observations whose responses on saving income are at the limit, hence superior efficiency, compared to other multivariate regressions based on only the non-limit observations (Tobin, 1958). It also enables estimation of both the probability of occurrence for the limit and the level of saving of the non-limit observations, given the explanatory variables.
Defining an unobserved or latent index variable \( S_i^* \) for a potential saving, we have the following estimation framework.

\[
S_i^* = \beta' K_i + u_i \\
S_i = \begin{cases} 
S_i^* & \text{iff } S_i^* > 0 \\
0 & \text{otherwise}
\end{cases}
\]

where \( \beta \) is a vector of parameters to be estimated; \( K_i \) is a vector of explanatory variables in the saving function specified in Equation (17), \( u_i \) are residuals assumed to be independently and normally distributed. Using the Tobit maximum likelihood estimation technique, we estimate \( \beta \) and \( \sigma^2 \) on the basis of observations on \( S_i \) and \( K_i \).

The marginal effects are calculated at the mean values of the explanatory variables using the decomposition procedure by McDonald and Moffit (1980) and Maddala (1983). Thus, it has to be noted that unlike the standard regression coefficients, the Tobit beta coefficients do not measure the change in expected savings of those who are above the zero limit. At the mean of the sample, the coefficients must be multiplied by the probability of being above zero to obtain coefficients for conditional saving.

**Model variables and hypotheses**

**Dependent variable:** The saving variable \( S_i \), measured in terms of total physical and financial assets for one-year period prior to the survey, was used as the dependent variable. In the data, 62% of the sample farm households had positive savings while zero values were observed for the remaining cases.
Explanatory variables: factors related to ability, willingness and opportunity of farm households to save were included in the model based on previous related studies and intuitive arguments presented. The definitions and hypothesized effects are discussed below.

Ability to save

In order to save, a farm household needs to have a capacity to generate income that make saving possible. It is hypothesized that the following factors play important roles.

Farm size (+): This is the total land operated by the farm household, including land owned, rented in, and contracted in. As a factor of production, land is complementary to labour and capital in agricultural production, contributing to household income and saving. Total output and income are expected to increase with the land size operated by the household and thus more saving is expected from the proceeds.

Farm assets (+): This variable captures the market value of total household physical properties, such as livestock, farm implements, machineries, inventories and other stocks. Wealthier farm households are expected to own more assets and have the potential for lumpy investments, which could generate more income. It is expected to have a positive relationship with farm household saving.

Farm income (+): This is income derived from farm outputs, including crops and livestock products, measured at market values. It forms part of the permanent income for the farm households. As the majority of farm households generate income from farm production, saving is expected to come mainly from the income left after consumption expenditures are deducted. We thus expect a positive relationship
between household income and household saving.

**Non-farm income (+):** This is income derived from non-farm economic activities generated through external labour supply, rentals of ox power, pack animals and land, handicrafts, petty trade, and so on. Such activities are carried out in the study area to supplement household income, especially during slack periods when labour is temporarily free from own farm activities. Income from these activities represents what is commonly known as transitory income. According to Friedman's income theory, such a transitory income is believed to contribute more than permanent income to household saving. Hence, we hypothesize this variable to positively affect farm household saving.

**Household labour force (+):** This refers to a number of economically active members of the household who are 10 to 65 years old. The higher the proportion of household members in this age group, the higher will be the provision for household labour supply in the farm and/or non-farm economic activities, thus increasing household income and saving.

**Dependency ratio (-):** This is the proportion of household members below 10 and above 65 years old to the total household size. Household members in these two age categories are assumed to have little or no productive contribution to household income generation. Instead, they are likely to reduce labour supply of the productive members as they demand labour for their care. Moreover, consumption increases with the size of dependents in a household (Modigliani, 1986). For two households with the same household size, the dependency ratio will be higher for a household with larger proportion of the dependents. Hence, a negative relationship with household saving is expected.
Willingness to save

The farm household’s ability to save alone cannot lead to saving. There should be sufficient incentives to motivate household saving. The incentives to save are likely to be affected by the following internal and external factors.

Saving interest rate (+): This reflects the rate of return on deposits in either formal or informal markets. An increase in the interest rate has two competing effects on saving: a positive effect through substitution and a negative one through the income effect (Romer, 2001: 346). The positive effect results if an increase in the saving rate increases the incentive to save in view of increased rate of return on saving, and savers decide to increase current saving by deferring consumption in the current period due to expected gain in the next period. The negative effect of increased saving rate on current saving is expected if the expected increase in interest income gain in the next period makes the household increase current consumption (thus decreases current saving). Hence the net effect is a priori ambiguous.

Farm experience (+): Some farmers may join farming after leaving school or after long military service. It is then more appropriate to use the number of years spent in farming as a measure of farm experience, instead of using age as a proxy variable. With increased number of years of farm experience farmers can develop farming skills through experiential learning. This may enhance their technical and allocative efficiencies and increase their income generation capacities. Moreover, with experience farmers may learn about strategies to cope with income fluctuations. Hence, farm experience is expected to have a positive relationship with saving.
Education level (+): This is the number of years of schooling of the farm household head. Education, as a proxy for human capital, is expected to increase labour productivity by influencing farm management skills and, thus, farm income. Moreover, since education is often related to ability to access and use of information, it contributes to a rational behaviour toward future expectations. Hence, a positive relationship with household savings is hypothesized.

Opportunity to save

The ability and willingness of a farm household to save requires a favourable external environment within which the ability can be explored to make use of the available opportunities. Here, the following factors are hypothesized as an external factor.

Distance to the nearest formal financial institution (+) is a physical distance of the residence of the farm household from the nearest formal financial institution. The more distant a financial institution is located from a farm household, the more costly it will be to make deposits, due to possible increase in transaction costs, and the more discouraged the farm household would be especially to make small deposits. It is often the formal institutions that are farther from farm households’ residence villages. If this distance significantly discourages their decision to make deposits, it is plausible to expect farm households to either make such deposits at nearby informal institutions or keep them at home. Therefore, this leads to expectation of negative relationship between distance to the formal financial institution and deposit savings in this type of institutions.

Irrigation dummy (+): It takes a value of one if the farm household partly or wholly uses irrigation farming, and zero otherwise. Rain-fed
farming is subject to rainfall fluctuations, which may adversely affect farm outputs. Access to irrigation increases the opportunity to generate more output and income by allowing increased factor use during dry seasons which otherwise would have remained idle. Moreover, irrigation involves lumpy investments on fixed assets such as water pumps and pipes, and requires more saving prior to investment and for unexpected repair and maintenance. Hence, it is hypothesized that irrigation farming is positively associated with saving.

**Investment dummy (+):** This takes a value of one if the farm household has invested in real assets, such as additional livestock, farm implements and equipment, or has sent additional school-age children to school during the study period, and zero otherwise. Saving is either for future consumption or investment. If a farm household has made investment in the current period, it must be the result of own savings, given the borrowing constraints. Hence, a positive effect on household saving is hypothesized.

In order to test the empirical validity of these hypotheses, the saving function in Equation (18) is estimated using maximum likelihood procedure.
Data

Study area and sample selection

The study used farm household survey data collected using structured questionnaire, which covered crop and livestock production, off-farm and non-farm activities, income, consumption and saving of the farm households. The survey was conducted during September 2004 to January 2005 in Merti and Adamitullu-Jido-Kombolcha (AJK) districts of Oromia region, Ethiopia. These districts are located about 200 km and 160 km, respectively, to the Southeast of the capital, Addis Ababa (Finfinnee).

The farm households were randomly selected from six Farmers’ Associations (FAs). They were selected based on the agro-ecological zones of the two districts—four from Merti and two from AJK (Table 1). The districts have diverse physical and socioeconomic characteristics with modest representation of the population. Using FA-level list of farm households as a sampling frame, 240 sample farm households were randomly selected. About 70% and 30% of the total sample farm households were selected from Merti and AJK districts, respectively. Survey enumerators, visiting the farm households at their farmsteads, administered structured questionnaire to each head of the household. Individual visits were used to minimize external noise that might affect response behaviour of farm households in dealing with sensitive questions, such as income and savings. They also helped reduce the non-response instances of sample farm households as the interviewer and the respondent come in direct interaction with each other, allowing clarification of ambiguities with respect to the questionnaire involved.
Table 1. Profile of sample farm households

<table>
<thead>
<tr>
<th>District/Farmers' association*</th>
<th>Total farm households</th>
<th>Sample farm households</th>
<th>Sample proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merti</td>
<td>1584</td>
<td>169</td>
<td>70%</td>
</tr>
<tr>
<td>Golugota (L)</td>
<td>443</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Waticha-dole (L)</td>
<td>370</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Homba (M)</td>
<td>438</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Re’ee-Amba (H)</td>
<td>333</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Adamitullu-Jido-Kombolcha</td>
<td>672</td>
<td>71</td>
<td>30%</td>
</tr>
<tr>
<td>Walinbula (M)</td>
<td>312</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Haleku (L)</td>
<td>360</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2256</strong></td>
<td><strong>240</strong></td>
<td></td>
</tr>
</tbody>
</table>

Note: *L = lowland; M = midland; H = highland

Characteristics of the sample farm households

The sample descriptive statistics are shown in Table 2. An average farm household was headed by a 43-year-old person who attended four years of formal education, had a household size of about eight persons, four of whom were in productive age and the rest were school or pre-school dependents. In terms of resources, a farm household operated 1.8 hectares of farmland, owned about 4.6 TLU* of livestock, assets with market value of about 14,634 Birr*. It had annual farm income of Birr 11,759 and non-farm income of 358 Birr, of which about 4,640 Birr was saved in financial and physical assets. The average household was located at 17 km away from a formal financial institution, a distance fairly representing geographical centres of the districts considered.

About 45% of the sample farm households had access to irrigation facilities, which use either water pumps operating on diesel engines and water pipes or gravity-based irrigation system. Those who had access to irrigation facilities were in the lowlands, which experience low

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*TLU is a standard tropical livestock unit using conversion factors for livestock categories. The factors are 1.2 (camel), 1.0 (cattle), 0.1 (sheep), 0.1 (goat), 0.8 (horse), 0.7 (mule), and 0.5 (donkey) (Kassa, 2003).

5 Ethiopian currency with exchange value of USS 1 = 8.70 Birr (Nov., 2006).
annual rainfall, and had smaller farm sizes, but had higher average incomes compared to those practicing rain-fed agriculture in the midlands or highlands. Those in the lowlands were also relatively more market-oriented with cash crop production, which has relatively higher market prices.

Table 2. Sample descriptive statistics of some socio-economic variables (n=240)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household head’s age (years)</td>
<td>43.25</td>
<td>14.12</td>
</tr>
<tr>
<td>Farm experience (years)</td>
<td>24.50</td>
<td>12.51</td>
</tr>
<tr>
<td>Household head’s formal education (years)</td>
<td>3.41</td>
<td>3.68</td>
</tr>
<tr>
<td>Household labour force (No. of persons)</td>
<td>4.36</td>
<td>2.52</td>
</tr>
<tr>
<td>Number of household members of age &lt;10 &amp; &gt;65 years</td>
<td>3.53</td>
<td>2.21</td>
</tr>
<tr>
<td>Distance to the nearest financial institution (km)</td>
<td>16.88</td>
<td>8.69</td>
</tr>
<tr>
<td>Monetary value of household farm assets ('00 Birr)</td>
<td>146.34</td>
<td>134.83</td>
</tr>
<tr>
<td>Household total annual farm income ('00 Birr)</td>
<td>117.59</td>
<td>123.98</td>
</tr>
<tr>
<td>Annual income from non-farm activities ('00Birr)</td>
<td>3.58</td>
<td>9.07</td>
</tr>
<tr>
<td>Household annual saved income ('00Birr)</td>
<td>46.40</td>
<td>52.81</td>
</tr>
<tr>
<td>Total farm size (ha)</td>
<td>1.80</td>
<td>1.23</td>
</tr>
<tr>
<td>Livestock number (in tropical livestock unit, TLU)</td>
<td>4.58</td>
<td>4.51</td>
</tr>
<tr>
<td>Annual interest rate (%)</td>
<td>5.80</td>
<td>18.28</td>
</tr>
</tbody>
</table>

Dummy variables                                      

<table>
<thead>
<tr>
<th>Dummy variables</th>
<th>Per cent of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per cent of household with positive annual saving</td>
<td>62</td>
</tr>
<tr>
<td>Per cent of household with investment</td>
<td>28</td>
</tr>
<tr>
<td>Per cent of household with irrigation facility</td>
<td>52</td>
</tr>
</tbody>
</table>

Source: Own survey (2004/5).

The annual average borrowing interest rate was 5.8%, ranging from 0 to 150 per cent. Those charged by formal institutions range from 7.5 to 12.5 per cent per year. The lower and higher rates of interest are in the informal sector, in which the interest-free credit was often linked to non-financial6 relationship between borrowers and lenders.

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6 For example, loans from friends and relatives, in which the borrower is expected to pay back only the
Results and Discussions

Farm households’ asset portfolios and saving behaviours

About 62% of the sample farm households reported positive savings in financial (57%), physical (24%) and both types (19%) of assets (Table 3). In terms of the amount saved, the financial assets were the highest, having average of Birr 5209.2, followed by physical assets at Birr 4642.4 and both financial and physical assets at Birr 4449.5. This shows that the farm households kept more of their savings in financial assets, contrary to what the analytical result in the theoretical part of this paper predicts in the absence of credit market constraints. It is, however, in line with the analytical result in the presence of borrowing constraints, in that the farm households save more in financial assets when felt constrained in the credit market. That is, as they expect facing credit constraint, they take the precaution of saving to remain liquid in case of any need.

About 89% of cash savers had informal savings while only less than 10% of the farm households saved in formal institutions (Table 4). The large majority in the informal saving had their cash savings kept at home showing that farm households are less integrated into the formal financial sector. This result is not surprising in view of the discussion we observed earlier in which it is argued that farm households in developing countries face borrowing constraints and, therefore, take principal without being charged the interest. It could also be loans based on reciprocal compensation mechanisms, including labour supply, output sales or any other relationships.
precautionary actions to maintain some liquidity by holding cash at home and livestock and/or crop outputs that can easily be liquidated.

Table 3. Farm household annual saving portfolios (n = 149)

<table>
<thead>
<tr>
<th>Saving types</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saving in financial assets</td>
<td>5209.2</td>
<td>5373.5</td>
<td>57</td>
</tr>
<tr>
<td>Cash at home</td>
<td>7617.6</td>
<td>6432.7</td>
<td>18</td>
</tr>
<tr>
<td>Cash in iddir</td>
<td>2572.0</td>
<td>2929.3</td>
<td>17</td>
</tr>
<tr>
<td>Cash at iqqub</td>
<td>2284.9</td>
<td>4044.2</td>
<td>12.7</td>
</tr>
<tr>
<td>Cash at bank /saving &amp; credit association</td>
<td>5902.4</td>
<td>4814.6</td>
<td>9.3</td>
</tr>
<tr>
<td>Saving in physical assets</td>
<td>4642.4</td>
<td>6105.7</td>
<td>24</td>
</tr>
<tr>
<td>Livestock purchase</td>
<td>6562.5</td>
<td>798.3</td>
<td>10</td>
</tr>
<tr>
<td>Stored grain</td>
<td>3580.2</td>
<td>4689.9</td>
<td>9</td>
</tr>
<tr>
<td>Stored grain and livestock</td>
<td>2768.2</td>
<td>3046.8</td>
<td>5</td>
</tr>
<tr>
<td>Saving in both financial and physical assets</td>
<td>4449.5</td>
<td>4150.9</td>
<td>19</td>
</tr>
<tr>
<td>Cash in iddir and stored grain</td>
<td>2617.5</td>
<td>3500.1</td>
<td>9</td>
</tr>
<tr>
<td>Cash at home and stored grain</td>
<td>6986.1</td>
<td>4307.9</td>
<td>6</td>
</tr>
<tr>
<td>Cash in iddir and livestock purchase</td>
<td>4802.5</td>
<td>2254.9</td>
<td>3</td>
</tr>
<tr>
<td>Cash at home and livestock purchase</td>
<td>5152.5</td>
<td>7286.7</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own survey (2004/5).

Table 4. Farm households' deposits of cash savings (n=140)

<table>
<thead>
<tr>
<th>Where deposited</th>
<th>Per cent</th>
<th>Where deposited</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal</td>
<td>88.6</td>
<td>Formal</td>
<td>9.3</td>
</tr>
<tr>
<td>At home</td>
<td>69.4</td>
<td>Bank</td>
<td>8.6</td>
</tr>
<tr>
<td>In iddir</td>
<td>15.7</td>
<td>Saving and credit association</td>
<td>0.7</td>
</tr>
<tr>
<td>In iqqub</td>
<td>2.1</td>
<td>Both informal and formal</td>
<td>2.1</td>
</tr>
<tr>
<td>At home &amp; in iddir/iqqub</td>
<td>0.7</td>
<td>At home and bank</td>
<td>2.1</td>
</tr>
<tr>
<td>With friends</td>
<td>0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own survey (2004/5).

Since households lack access to sources of credit for consumption in contrast to credit for production, to which credit programmes for the
purchase of farm inputs are specifically targeted by the government, they are under the necessity of holding stocks of currency, grains and other liquid assets meet consumption needs. This may lead to a situation where households are more likely to underinvest in illiquid but more productive assets because of concerns to protect consumption from unexpected fluctuations. Since farmers account for about 85% of the total Ethiopian population, the higher proportion of farm households holding savings at home or informally will have a considerable negative effect on formal financial institutions that should mobilize loanable funds through domestic savings.

The reasons why savers prefer to deposit their cash savings in informal institutions rather than at formal ones, such as banks, credit unions and farmers’ cooperatives were assessed and the major reasons identified are presented in Table 5. The most frequent reasons were perceived small volumes of saving (52%), precautionary need for cash (17%) and low real returns on cash savings (8%). The perception of small saving volumes, which seem to be overwhelming, is linked to incurring possible costs to make such deposits in uneasily accessible formal financial institutions. Lower returns on deposits, coupled with higher transaction costs in depositing small savings in a physically/socially distant and inefficient formal financial institution, are possible forces that might discourage farm households with small volumes of savings since returns to deposits might not compensate for real costs to create incentives for formal savings. Precautionary need for cash could be explained in terms of farm households’ limited access to formal sector credit. Institutional constraints, such as lack of trust in banks, the physical and social distance of banks, lack of information on banking, and lengthy banking procedures were also among the reasons reported.
Based on the reported informal savings of the farm household, possible investment types preferred by the farm households were also analyzed (Table 6). About 28% of the sample farm households reported different forms of investments, namely, livestock enterprise, crop enterprise, housing and education. About half of the farm households with cash savings indicated investment in livestock is characterized by returns realized as milk and milk products, new born calves, draught power, fattening and so on. This type of investment was carried out at an average saving of about Birr 1,039. Investment in crop enterprise, by about one-fourth of the farm households with cash savings, was in the form of land rent and farm implements.

Investment in housing had the highest mean value. It was observed that some farmers built houses at nearby towns mainly for two purposes: to generate rental income by renting to urban residents and to use ownership rights of the houses as collaterals to obtain loans from commercial banks for farm operations and other investments, which otherwise would have been impossible. In the study areas, this seems a

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7 Under the current Ethiopian law, land is a public property and farmers do not have the right to privately own the land, but they have use right. So, formal financial institutions do not accept farmlands as collateral
new strategy of the farm households to overcome their lack of farmland property rights to get access to formal credit. It is also an indication of farm households’ demand for credit, which would likely be unmet in the absence of such alternatives. This behaviour of the farm households signifies the importance of land property rights to get access to formal credit. In a related study, for example, Besley (1995) also found positive relationship between land ownership and access to credit in Ghana. In terms of on-farm investment, Bekele and Drake (2003) also noted positive correlation between ownership security and investment in soil and water conservation in eastern highlands of Ethiopia.

Table 6. Farm households’ investment by type of investment (n=68)

<table>
<thead>
<tr>
<th>Type of investment</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock enterprise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock purchase</td>
<td>1039.3</td>
<td>882.1</td>
<td>50</td>
</tr>
<tr>
<td>Crop enterprise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land rented in</td>
<td>1003.3</td>
<td>1310.7</td>
<td>15</td>
</tr>
<tr>
<td>Farm implements</td>
<td>365.0</td>
<td>445.5</td>
<td>9</td>
</tr>
<tr>
<td>Housing and human capital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home construction</td>
<td>6358.3</td>
<td>10362.8</td>
<td>12</td>
</tr>
<tr>
<td>Furniture</td>
<td>393.3</td>
<td>340.2</td>
<td>6</td>
</tr>
<tr>
<td>Audio items</td>
<td>1245.0</td>
<td>502.0</td>
<td>4</td>
</tr>
<tr>
<td>Children education</td>
<td>905.0</td>
<td>687.6</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own survey (2004/5).

for loans.
Econometric results and discussions

To analyze the probability, conditional mean, and the determinants of farm household saving, a Tobit regression model specified in Equation (18) was estimated using maximum likelihood estimation using LIMDEP econometric software (Greene, 1992), and the results are presented in Table 7. The null hypothesis that all the estimated slope coefficients were equal to zero was tested using likelihood ratio test, which uses the log likelihood ratio, \( \lambda = -2(L_r - L_u) \), where \( L_r \) and \( L_u \) are the log likelihood functions for restricted and unrestricted models, respectively. The result for \( \lambda \) was 405.44, leading to rejection of the null at 1% significance level. The pseudo-\( R^2 \) measure also shows that 76% of the variation in the dependent variable was explained by the regressors included in the model.

The conditional mean annual saving was estimated at Birr 4361.86 for a farm household with the predicted probability of saving of 0.97. This probability value was used to calculate the marginal effects at average values of the explanatory variables, as reported in the right-hand column of Table 7.

Among the 12 explanatory variables included in the model, seven were statistically significant at less than 10% significance levels. While land size, farm and non-farm incomes, access to irrigation and investment motive were highly significant (\( p < 0.01 \)), education level and farm experience were significant at 5% and 10% levels, respectively. In terms of the direction of influence, except education level, all the other variables support our hypotheses. In the following section, we will discuss the significant variables.
Table 7. Tobit coefficient estimates and marginal effects of saving function

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficients</th>
<th>Marginal Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm size</td>
<td>4.439 (1.466)**</td>
<td>4.312 (1.423)**</td>
</tr>
<tr>
<td>Farm asset ('00 Birr)</td>
<td>-0.026 (0.017)</td>
<td>-0.025 (0.017)</td>
</tr>
<tr>
<td>Farm income ('00 Birr)</td>
<td>0.399 (0.020)**</td>
<td>0.387 (0.020)**</td>
</tr>
<tr>
<td>Non-farm income ('00 Birr)</td>
<td>0.536 (0.170)**</td>
<td>0.520 (0.165)**</td>
</tr>
<tr>
<td>Household labor force</td>
<td>0.323 (0.788)</td>
<td>0.314 (0.766)</td>
</tr>
<tr>
<td>Dependency ratio</td>
<td>-8.039 (9.678)</td>
<td>-7.808 (9.401)</td>
</tr>
<tr>
<td>Saving interest rate</td>
<td>0.052 (0.089)</td>
<td>0.051 (0.086)</td>
</tr>
<tr>
<td>Farm experience</td>
<td>3.606 (2.088)*</td>
<td>3.502 (2.028)*</td>
</tr>
<tr>
<td>Education level</td>
<td>-0.865 (0.447)**</td>
<td>-0.840 (0.434)**</td>
</tr>
<tr>
<td>Distance from formal financial institution</td>
<td>-0.024 (0.219)</td>
<td>-0.023 (0.213)</td>
</tr>
<tr>
<td>Access to irrigation dummy (=1 with access)</td>
<td>11.917 (4.043)**</td>
<td>11.575 (3.922)**</td>
</tr>
<tr>
<td>Investment motive dummy (=1 with investment)</td>
<td>9.311 (3.455)**</td>
<td>9.043 (3.354)**</td>
</tr>
</tbody>
</table>

The dependent variable is annual saving; Conditional mean (Birr) = 4361.86; -2Log-likelihood = 405.44; Number of observation = 240; Pseudo R² = 0.76; Estimated Probability= 0.97; ︖ = 22.82

Note: Standard errors are in brackets; ***, ** and * indicate 1%, 5% and 10% significance levels, respectively.

Farm size showed a significant positive effect on farm household saving. From the partial effects, we see that for a one-hectare increase in farm size, annual saving increases by Birr 431, given all other variables are held constant at their average values. It needs to be noted that the statistical insignificance of the farm household asset supports the analytical result of Equation (10) in the theoretical section of this paper, where household saving of a physical asset was derived to be independent of household wealth.

Both farm and non-farm incomes were statistically highly significant. However, the magnitude of the coefficient of non-farm income was larger than that of farm income, indicating higher share in total saving.
Saving Behaviours of Farm Households... Hussien, Öhlmer and Bezabh/ 33

of the non-farm income. This suggests that non-farm income plays a transitory income role, with higher probability to be saved, which is in line with theoretical expectations (e.g., Paxson, 1992). Evaluated at the mean value, a one-Birr increase in non-farm income is likely to raise farm household saving by about 52 cents, while it is 39 cents for farm income. Since, on average, farm households operated small farm sizes, there could likely be an excess labour supply to the non-farm sector. However, the small proportion of farm households with non-farm income shows that there were little employment opportunities in the non-farm sector in the study area allowing farm households to use their family labour endowments.

Another significant factor affecting household saving was farm experience. It indicates that a one year increase of farm experience of the farm household’s head at the mean value of 24.5 years, ceteris paribus, would result in an increase in the expected annual saving of Birr 350. This shows that with increased experience, the farm household is likely to save more for future consumption. This leads us to the fact that farmers learn from experience. They are aware of the necessity of saving through current accumulation to smooth consumption in the future as agriculture involves income fluctuation. Contrary to our hypothesis, which argued for positive correlation between education and saving, the econometric result did not support the claim. With increased years of schooling of farm household heads, saving was decreasing. This counterintuitive result could be related to three possibilities. Firstly, in traditional agriculture, such as that practiced in Ethiopia, schooling seems to create little added value to farm products, which is probably associated with the school curricula, which does not specifically address agricultural problems. Or perhaps, a higher level of schooling was required to yield significant positive effect on saving. Secondly, those with formal education are more likely
to have access to urban centres and spend more in urban consumption goods and services such as clothes and drinks, which result in lower current savings. Thirdly, farm households who are better educated are more likely to send their children to school, incurring higher expenditure on education at the expense of savings. The fact that the accrued interest is not attractive to farm households, they are not motivated to save. Even though they have positive correlation, since interest incomes on smaller amounts of savings cannot compensate for possibly higher transaction costs to make deposits, the farm households may not have sufficient incentive to save based on the interest rates. This is consistent with the descriptive results, where low return on bank deposits was one of the reported reasons for their deposits outside the formal institutions, where 69% held their savings at home, which is an indication of farm households’ low level of integration in the formal financial market. This also suggests that other factors are likely to be more important than the nominal interest rate to create incentives for farm households to increase their formal savings.

Farm households with farm-level investment motive had annual saving higher by Birr 931 than those without the investment motive. This result suggests that if a farm household intends to make farm-level investment, it is more likely to make more savings, which is consistent with a theoretical expectation of saving behaviour under borrowing constraints as argued in the theoretical part of this paper. Those with access to irrigation facilities had annual savings higher by Birr 1191 than those without access. This supports our hypothesis that access to irrigation increases the opportunity to generate more output and income by allowing increased factor use during dry seasons which, otherwise, would have remained idle. It also contributes to farm household savings by reducing the adverse effect of shortage of rainfall, which often causes crop failure and income fluctuations.
Conclusions and Policy Implications

Farm households, the majority being smallholders, are the largest proportion of the Ethiopian population, which has substantial economic impact on the national economy. Farm household saving is a significant component of total private domestic savings. Mobilizing savings is an important policy instrument to improve resource allocation in the economy, thereby enhancing economic efficiency. This study shows that more than three-fifth of the sample farm households had positive savings in both financial and physical assets. However, only less than one-tenth of those with financial savings had deposits in formal financial institutions. The major reasons were perceived small volumes of saving (52%), precautionary need for holding cash (17%) and low real return on bank deposits (8%). The perception of small saving volumes, which seem to be overwhelming, might be linked to possible costs to make such deposits in uneasily accessible formal financial institutions. This suggests that financial institutions with easy access, low transaction costs, higher real returns on savings and convenient withdrawal of savings as needed may provide incentives to attract those who hold financial savings in informal institutions. This can also improve the reserve base of the formal financial institutions and enhance financial intermediation. In addition, farm households' precautionary need for cash can be explained in terms of their limited access to credit from external sources, in general, and from the formal credit sector, in particular.

Moreover, farm household saving is significantly affected by farm size, farm and non-farm incomes, farm experience, access to irrigation, and education level and investment motive of farm households. These
factors determine the farm households’ capacities, incentives and opportunities to save. Both the descriptive and econometric results suggest the need for appropriate strategies to effectively reduce transaction costs, improve real returns on savings, improve farm productivities and create non-farm employment opportunities, given the limited scope to increase farm sizes and reduce risks which spur farm households’ precautionary savings.

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References


Credit sectoral choice of farm households and its determinants in imperfect credit markets of Southeastern Ethiopia

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Abstract

Rural credit markets in developing countries in general and particularly in Ethiopia are segmented into different sectors — formal, semiformal and informal. Since early 1990s, major reforms have taken place in Ethiopian financial system and allowed the private financial sector to enter into competition with the existing state-owned financial institutions in the provision of financial services, one of which is rural credit supply. However, farm household credit sectoral choice and its influencing factors were little known under the reform. Thus, this paper analyzes credit sectoral choice of farm households in a multinomial logit framework using farm household survey data from two districts of southeastern Ethiopia. The survey shows that about 55% of the sample farm households borrowed from different sources of credit. Conditional choice probabilities were estimated at 0.3167, 0.1667 and 0.5167 for formal, semiformal and informal credit sectors, respectively. This suggests that the informal credit sector dominates the rural financial market, despite the reform’s hoped-for expansion of formal credit to rural areas. However, since the informal credit sector exhibits exorbitant interest rates, shortage of loanable funds, short-term loans, and is susceptible to covariate risks affecting local economies, it is less likely to meet farm households’ existing and potential demand for credit. Hence, it is suggested that in order to increase formal and semiformal financial sectors’ share in rural credit market, their lending policies and instruments need to be more compatible with farm households’ borrowing characteristics.

JEL Classifications: D45, D82, D83, O16, O17.
Keywords: Rural finance; credit segmentation; borrowing behaviour; multinomial logit; developing countries.

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^Correspondence address: Department of Economics, Swedish University of Agricultural Sciences, Box 7013, SE-750 07, Uppsala, Sweden; Tel: +46-18-671791; Fax: +46-18-673502; E-mail: hhkomicha@yahoo.com or Hussien.Hamda@ekon.slu.se (H.H. Komicha)
1. Introduction

Rural credit market segmentation into different sectors has long been recognized in the literature on credit markets in developing countries (e.g., Guirkinger, 2005; Gonzalez-Vega, 2003; Adams, 1995; Hoff and Stiglitz, 1990; Braverman and Guash, 1986). In the course of economic development and in light of formal credit sector expansion, the market share of informal credit sector is expected to reduce (Bardhan, 1978; Lipton, 1976). However, studies on sectoral choice behaviour of farm households are generally scarce in Sub-Saharan Africa (SSA) and particularly lacking in Ethiopia. In Ethiopia, the agricultural sector employs the majority (about 80%) of the labour force, with the services and manufacturing sectors accounting for the remaining 15% and 5%, respectively (CSA, 2006). It also accounts for about one-half of the GDP and nine-tenth of the export earnings of the country. Smallholder farm households make up for the largest proportion of the Ethiopian population, which is estimated at 77 million in 2006. Sectoral choice of this large proportion of population has significant economic impact. Rural infrastructure in general is underdeveloped (EEA, 2004) and lenders and borrowers face considerable information problems. Imperfect information increases borrowers’ search costs (Becsi et al., 2005), which may be too high for some borrowers to pursue and thus end up with a particular lender in the neighbourhood, irrespective of possibly higher interest rate charged. For a particular internal rate of return of a credit-financed enterprise, higher interest rate results in lower profitability of the loans to the borrowers due to debt service requirements. This will have an adverse effect on farm households’ incentive to demand for credit.

Depending on the degree to which a sector is subject to government regulatory framework such as registration, licensing, interest rate control, external audit and taxation, the Ethiopian financial system consists of formal, semiformal and informal sectors, with large variation in lending interest rates (Admassie et al., 2005; Emana et al., 2005; Gobezie, 2002). The formal financial system, regulated by the National Bank of Ethiopia, consists of commercial banks, development banks, and nonbank financial institutions such as insurance companies and microfinance institutions. The semiformal sector, subject to limited government regulation, includes credit cooperatives, mutual funds and self-help associations. The informal sector is often outside the regulatory framework (Emana et al., 2005; Gobezie, 2005; Gobezie, 2002; Aredo, 1993; Begashaw, 1978) and comprises ikkub (a type of rotating savings and credit association), iddir (a type of traditional social insurance association), neighbours, relatives, friends, traders and moneylenders.

The Ethiopian financial system has undergone several reforms since early 1990s. Following the reform, the private financial sector has entered the financial system in competition with the existing state-owned financial institutions in financial service provision, one of which is rural credit supply. The reform is expected to affect the rural credit structure faced by farm households. However, official reports indicate that commercial and development banks in Ethiopia extended less credits than expected and held more reserve deposits than legally warranted (IMF, 2006), accommodating only insignificantly for small farmers’ demand for credit (EEA,
As a result, most rural borrowers have limited access to and often rationed out in the formal financial sector (Gobezie, 2002), even though credit is crucial for adopting improved production technologies such as fertilizer, pesticides, herbicides and improved seeds (Croppenstedt et al., 2003). The main reason is that most of the formal sector institutions are located in large urban centres and face asymmetric information problem, which in turn limit their operations to rural and smaller urban areas (Gobezie, 2002). Moreover, the formal sector targets only production credit, i.e. for farm inputs, not consumer credit (Admassie et al., 2005). However, repayment capacities of borrowers and thereby default management of financial institutions are often linked to diversified portfolios of borrowers (Admassie et al., 2005; Holinger, 2004; Roberts and Hannig, 1998).

Since the 1975 ‘land-to-the tiller’ proclamation, per capita farm size has declined enormously in Ethiopia, mainly due to growing population. In light of this, farm households may have to engage in off-farm economic activities to diversify income and support livelihoods. However, smallholders are often rationed out in the formal sector; rural labour markets are less developed to employ their surplus labour; and entry barriers such as lack of adequate resources for own internal financing and/or lack of credit limit participation in the nonfarm economic sector (Admassie et al., 2005; Amha, 2002; Woldehana and Oskam, 2001). These factors reinforce the importance of semiformal or informal credit sources for the farm households. Although, loans from informal or semiformal sources are considered to be relatively easier to obtain and are more flexible to repay, compared to the formal credit sector (Pal, 2002), in low-income economies these sources face limited loanable capital to meet large credit demand and charge high interest rates (Gobezie, 2002; Emana et al., 2005). This can make businesses less profitable for borrowers.

Given rural financial market imperfection in Ethiopia, different households may have varying degrees of preferences towards one or another source in view of their demographic and socioeconomic characteristics as well as loan characteristics. Knowledge of factors that significantly influence farm households’ credit sector choices can improve rural credit policy design to enhance rural financial intermediation and resource allocation in the economy. However, to the best of my knowledge, there has been no empirical study of sectoral choice of farm households in Ethiopia, in general, and particularly in the study areas. Thus, this study attempts to bridge this empirical gap with the objectives of (a) analyzing farm households’ choice probability among informal, semiformal and formal credit sources, and (b) identifying demographic and socioeconomic characteristics of farm households and loan characteristics affecting sectoral choice probabilities. The study used data from a farm household survey conducted in Merti and Adamitu-Jido-Kombolcha (AJK) districts in southeastern Ethiopia, where agriculture is the main economic activity of the farm households. The paper proceeds by briefly reviewing related literature in the next section, followed by a conceptual framework of credit sector choice and the employed empirical model in third section. Describing the data used

The survey was conducted during September 2004 to January 2005 by trained enumerators under the author’s supervision.
for empirical estimation in the forth section, results are presented and discussed in the fifth section. Finally, some conclusions are drawn and policy implications are suggested.

2. Review of related literature

The prevalence of rural credit market imperfection in developing countries and its apparent segmentation into different sectors – formal, semiformal and informal – is well recognized in the credit market literature (e.g. Guirkinger, 2005; Gonzalez-Vega, 2003; Adams, 1995; Braverman and Guash, 1986). The literature explains persistence of informal credit sector in terms of spillover demand, lower effective costs and risk sharing (Guirkinger, 2005). First, it is argued that farmers procure expensive informal loans because they are denied access to cheaper, formal loans. This is mainly because of the consequence of the asymmetries of information prevailing in the formal sector, which require significant collateral to be posted. Those without this collateral are effectively quantity rationed, or involuntarily excluded from the formal loan sector. Empirical studies also demonstrate the importance of excess demand for formal loans that spills over into the informal sector (Bell et al., 1997; Conning, 1996). Second, differences in effective monetary costs across different credit sectors are considered an important factor for persistence of informal sector. That is, depending on relative magnitudes of transaction and interest costs, informal loans may actually be cheaper than formal loans. For example, Kochar (1997) and Chung (1995) argue that informal borrowers are not necessarily constrained in the formal sector but find informal loans relatively cheaper when non-interest costs are factored into accounts of total cost of borrowing. Third, the degree of risk sharing across borrowers and lenders are also used to explain the persistence of informal credit sector. Boucher and Guirkinger (2004) argue that informal lenders’ information advantage allows them to substitute higher interest rates for lower collateral, leading to a situation where risk-averse borrowers may prefer an informal loan for its insurance feature regardless of its higher cost. That is, the informal sector allows farmers to invest in profitable enterprises they would otherwise not undertake, being reluctant to assume the risk of a formal loan. It is also argued that informal lenders are easier to negotiate with in case of a negative shock and to offer refinancing terms (Pal, 2002). These arguments suggest that cheaper interest rates are not sufficient for the dominance of a sector in a credit market. Spillover demand in the formal sector, lower effective demand in the informal sector and the possibility of risk sharing in the informal sector would lead to informal sector’s persistence in the credit market despite its considerably higher interest rate.

In developing countries, asymmetric information, high risks, lack of collateral, lender-borrower distance, small and frequent credit transactions of rural households make real costs of borrowing vary among different sources of credit. Moreover, institutional infrastructure required to deal with contractual problems is not adequately developed (Bigsten et al., 2003; Fleisig, 1995). If information required for screening or monitoring borrowers is too costly, lenders may be engaged in
loan-size rationing or may not lend to particular applicants at all (Stiglitz and Weiss, 1981; Braverman and Guash, 1986). In this situation, lending institutions often use collateral substitutes such as joint liability and third-party guarantee (Ghatak, 1999; Chowdhury, 2005). For example, joint liability and monitoring of co-borrowers is used to mitigate risk of default in a group-lending approach (Besley and Coate, 1995). In addition to this, most microfinance institutions use compulsory saving deposits prior to credit delivery as a way of assessing repayment capacities and commitments of borrowers, and some also link current loans to possible future loans as a disciplining mechanism to bid down possible credit default (Admassie et al., 2005; Gobezie, 2002).

A farm household is said to have access to credit from a particular source if it can borrow from that source but said to participate in a credit market if it actually borrows from that source (Diagne and Zeller, 2001), which suggests that a farm household can have access but may choose not to participate in the credit market. The literature on rural credit markets in developing countries generally show that farm households either are rationed out or lack complete access to subsidized formal credit (Bolnick, 1992; Besley, 1994; Levenson and Besley, 1996; ADB, 1997), although the degree of rationing varies under various circumstances. For example, Kochar (1997), having estimated the demand and sector-specific costs of credit and the extent of formal sector rationing in India, concluded that the extent of rationing was considerably less than generally thought in the literature. However, more recent studies in the same country (Pal, 2002; Bali Swain, 2002) found yet significant rationing in the formal credit sector. Pal (2002) argues that rationing of the formal credit was not the only factor inhibiting the spread of formal credit but easy and adequate access and prompt recovery in the informal sector were significant determinants of the popularity and viability of informal rural credit among households.

Given lack of access to formal credit markets, farm households (especially the poor with little to offer as collateral) often turn to semiformal or informal lenders (Bolnick, 1992; Levenson and Besley, 1996). For example, 70% and 85% of adults in Cameroon and Niger, respectively, participate in the informal financial market (ADB, 1994). Similarly, Emana et al. (2005) observed that 74% of borrowers in four regions of Ethiopia obtained credit from informal sources. Buckley (1997) also noted rotating saving and credit associations (ROSCAs) as the most important informal credit source next to friends and relatives. Under most environments in low-income countries, neighbours, friends and relatives are often the most important sources of informal credit (WorldBank, 1989; p.112).

Several other studies also indicate that most small farmers and rural entrepreneurs face great difficulty in accessing formal credit sector, which often are located in urban areas (Komicha et al., 2007; Duong and Izumida, 2002; Meyer, 2002; Gobezie, 2002; Adams, 1995). FAO and GTZ studies (Roberts and Hannig, 1998), which drew on the organizations’ own experiences and other studies, attributed this to several factors. These are poor rural infrastructure, farmers’ sparse locations, discouraging bank practices and procedures alienating rural clients, small volumes of loans demanded by small farmers, and banks’ lack of essential information on the credit history of potential clients, the viability of on-farm investments, self-
financing capacity of farmers and their repayment capabilities. Most of these factors raise transaction costs for lenders and borrowers in the formal credit sector (Iqbal, 1988), but could be reduced considerably in the informal or semiformal sectors, making the charged interest rates in the informal sector effectively lower than it nominally appears when those factors are factored in (Bouman, 1990). In developing countries, institutional infrastructure is either missing or inadequate and as a result, costs of contractual enforcement are too high and prohibitive for formal lenders to reach out some potential borrowers (Fleisig, 1995). Some formal financial institutions use local information and social mechanisms to enforce contracts, in which informal and semiformal sectors have relative advantages over the formal sector (Levenson and Besley, 1996; Besley and Coate, 1995; Adams and Fitchett, 1992).

Different lenders try to overcome information and contract enforcement problems in various ways. Formal lenders use rationing credit applicants who would like to borrow at even higher interest rates (Stiglitz and Weiss, 1981). Semiformal lenders use loan groups to which borrowers self-select themselves, based on their ability to monitor each other’s loan use and repayment capacities (Admassie et al., 2005). Informal lenders provide loans only to households they know well or can closely monitor (Basu, 1983) and tie loans with labour or product supply (Mekonnen, 2002). For example, Mekonnen (2002) noted that in Ethiopia 29% of borrowers were related with lenders in labour sharing, 5% each with input marketing and oxen sharing and about 4% with crop output marketing arrangements. Some recent studies (e.g. Gobezie, 2005), however, show that group lending approach effectively ration out some groups of farm households (e.g. the poorest of the poor and the landless). That is, co-borrowers tend to self-select themselves into a group of homogenous members that effectively discriminates against some others to reduce risk of carrying the burden of repayment in case of defaults of co-borrowers.

Imperfect information literature in credit markets mainly focuses on information problems of lenders about borrowers in extending loans but does not contain information problems of borrowers to obtain loans. Yet, rural people in many cases are even unaware of the availability of credit from a given source, or of the conditions under which credit is available (Roberts and Hannig, 1998). For example, in Nigeria, Anyanwu (1994) noted a situation where women lacked knowledge of credit availability in spite of the presence of a lending source out in the credit market to accommodate them. Such lack of knowledge could be attributed to factors such as rural households’ low literacy levels, unavailability of accessible market information, sparse locations of rural communities coupled with lack of adequate transportation and communications infrastructure, and limited and urban-skewed distribution of formal financial institutions (Komicha et al., 2007). These result in high transaction costs of farm households to get access to these institutions. Absence of alternative competitive lenders in a particular location can also result in monopoly pricing of interest rates of few localized informal institutions, to the disadvantage of smallholder farmers.

Empirical evidences also indicate that informal lenders are preferred for their local and timely access, speedy disbursement, flexible repayment, and easy or minimum bureaucratic procedures (Pal, 2002; Sinha and Matin, 1998). They are
often built on informal relationships embedded in the value system common to both lenders and borrowers, and involve lower transaction costs to the borrowers, as lenders are often located close to the borrowers geographically, culturally and socially (Gonzalez-Vega, 2003). However, the literature also suggests that informal lenders' services are limited to local environments, few products, and short terms and vulnerable to covariate risks affecting all members of the local communities such as droughts, floods, pests and diseases. This is mainly because the informal lenders operate within a local community limited by the wealth constraints of the local economy (Carpenter and Jensen, 2002; Gonzalez-Vega, 2003). Moreover, it is also argued that informal lenders cannot provide legitimate and safe deposit services, convenient mechanisms to transfer funds across regions and cannot provide large long-term loans.

From lenders' point of view, lending risks result from inadequate information on both the borrower's intention to default, which is idiosyncratic, and ability to meet repayments under unforeseen circumstances, which can possibly be either idiosyncratic or covariate (Christensen, 1993). Structural differences in the cost and risk characteristics of different types of transactions also explain credit market segmentation into different sectors (Hoff and Stiglitz, 1990).

The empirical literature on policy practices in different countries, although quite limited, generally supports inter-sectoral linkages. For example, in Sub-Saharan Africa the African Development Bank (ADB) advocates linkages between informal and formal sectors of the financial markets in order to improve savings mobilization and to integrate the financial system (ADB, 1997). The World Bank is in favour of designating leading institutions, which enjoy the cooperation and commitment of governments and central banks, to link microfinance programs with the informal sector and commercial banks (WorldBank, 1989). Snow and Buss (2001) also argue that extending the reach of the formal sector through microfinance is desirable depending on macroeconomic reforms, respect for traditional financing relationships and local control of institutions. Based on observation of the failures of many developing countries' efforts to spur desirable income growth and reduce poverty in rural areas by making low-interest loans to farmers, Yaron and Benjamin (1997) contend for a broader approach emphasizing policy and legal reforms and savings mobilization efforts encompassing formal-informal sector interactions in rural credit markets. Nagarajan and Meyer (1996) argue for formal-informal sector linkages through nongovernmental organizations. In Ethiopia, however, the successive financial policies have neither supported the functioning of informal credit sector nor provided for intersectoral linkages. For example, Emana et al. (2005) noted that private moneylenders operate secretly to provide loans at interest rates higher than the official rate since the Ethiopian civil and penal codes have considered private money-lending practices as usurious and thus illegal. However, despite this policy against informal lenders and increased efforts to expand formal loans, borrowing from informal sources seem to have remained dominant.
3. Methodology

3.1 Conceptual framework

A representative farm household may or may not have an outstanding loan at any given point in time considered in a cross-sectional survey. For a farm household observed with an outstanding loan, this can be from either formal, semiformal, informal or combination of these sources of credit (Pal, 2002), where distinction is made among these sectors based on the extent to which they are subject to state regulation. That is, a formal credit sector falls under the full control of state credit laws, and an informal credit falls outside such control (Seibel, 1985), the semiformal sector being an intermediate one subject to partial control of such laws. The sample farm households are observed self-selecting themselves into categories shown in Table I.

Table I: Categories of credit sources

<table>
<thead>
<tr>
<th>Category</th>
<th>Source of credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>C_{0,0,0}</td>
<td>No outstanding loan from any sector</td>
</tr>
<tr>
<td>C_{1,0,0}</td>
<td>Only formal sector loans</td>
</tr>
<tr>
<td>C_{0,1,0}</td>
<td>Only semiformal sector loans</td>
</tr>
<tr>
<td>C_{0,0,1}</td>
<td>Only informal sector loans</td>
</tr>
<tr>
<td>C_{1,1,0}</td>
<td>Both formal and semiformal sectors</td>
</tr>
<tr>
<td>C_{1,0,1}</td>
<td>Both formal and informal sectors</td>
</tr>
<tr>
<td>C_{0,1,1}</td>
<td>Both semiformal and informal loans</td>
</tr>
<tr>
<td>C_{1,1,1}</td>
<td>All the three sectors</td>
</tr>
</tbody>
</table>

In this categorization, farm households without any outstanding loan, i.e., category C_{0,0,0}, are those (a) who may not have any demand from all sectors for a number of reasons, e.g., low return on capital and low level of infrastructural facilities restricting their demand for credit even if they have access to it (Bali Swain, 2002) or they may have enough financial assets to invest (Pal, 2002) or (b) who demand for a particular sector only, but given the rationing or other constraints in that sector, cannot access it and also decide not to borrow from another sector for some reason. Relative costs and benefits in each sector may lead to specific choice of the farm households such that farm households who have demand for credit and have access to only formal C_{1,0,0}, semiformal C_{0,1,0} or informal C_{0,0,1} loans can be observed. Categories formed from a combination of two or more sectors – i.e., categories C_{1,1,0}, C_{1,0,1}, C_{0,1,1} and C_{1,1,1} – can also be observed if, given loan-size rationing in one or two sectors, the farm households borrow from the other one or two sectors beyond what they could borrow from the sector of their first choice.

Farm households with different characteristics and factor productivities may find differently the interest rates for loans for different purposes and periods, even if it is from the same sector. Transaction costs to obtain specific credit may also vary with loan size and source of the loan. Some sectors may require physical assets as collaterals, whereas in others such type of collateral may be less essential. For example, in a situation where a farm household does not have the required
collateral for a formal credit, it may look for an informal credit source where loans can be obtained without collateral. Given heterogeneity in household characteristics, one is likely to observe some households having a comparative advantage in borrowing from the informal sector, irrespective of higher interest rates charged. This suggests that interest rates, which are direct costs of borrowing, may not be a crucial factor in determining one’s sectoral choice. Other policy-relevant factors may also come into play.

The probability that a farm household \( i \) chooses lender \( j \) to borrow from can be written as a function of farm household characteristics \((H_i)\), non-interest loan characteristics of lender \( j \) \((L_j)\), and lending interest rate \((r_j)\):

\[
P_{ij} = f(H_i, L_j, r_j)
\]

A farm household \( i \) chooses lender \( j \) if the indirect utility of borrowing from lender \( j \) exceeds that from all other lenders, and if the benefits of the loan exceeds the costs, in the spirit of a random utility maximization (RUM) model (Luce, 1959; Manski and Lerman, 1977; McFadden, 2001). That is,

\[
V_{ij} = \beta_j X_{ij} + \epsilon_{ij} > V_{ik} = \beta_k X_{ik} + \epsilon_{ik}, \quad \forall j \neq k
\]

\(
\Rightarrow \epsilon_{ij} - \epsilon_{ik} > \beta_k X_{ik} - \beta_j X_{ij}
\)

where \( \beta_j X_{ij} \) and \( \beta_k X_{ik} \) include all the non-idiosyncratic components of the indirect utility functions; \( \epsilon_{ij} \) and \( \epsilon_{ik} \) being the random error terms capturing unobserved heterogeneity in preferences across otherwise identical farm households. It follows that the probability that a farm household chooses lender \( j \) will depend on the characteristics of loans from all other sources accessible to the borrower.

### 3.2 Empirical model specification

In the survey, the sample heads of farm households were asked whether the household borrowed in a year that preceded the date of the survey or not, and to indicate their credit sources. In addition, data related to borrower and loan characteristics were collected. In the data, about 45% of the respondents indicated that the households had no outstanding loans. This group was assigned category \( C_{0,0,0} \). About 55% of the respondents indicated that the households had borrowed during the reference period and indicated the sources of credit, which were classified into three categories: formal \( C_{1,0,0} \), semiformal \( C_{0,1,0} \), and informal \( C_{0,0,1} \). As combinations of the sectors were not reported, we did not have other categories presented in the previous section. All together, we had four categories assigned

unordered values of 0 to 3, which could be used to estimate choice probabilities of farm households among these categories. In the literature there are two ways of estimating the multinomial choices, i.e., using multinomial probit or multinomial logit, and it is suggested that the latter is computationally more convenient than the former (Maddala, 1983). Therefore, we employed a multinomial logit (MNL) model by assuming that the error term $\varepsilon_{ij}$ is independently and identically Type I extreme value distributed (McFadden, 2001). In this model, the individual-specific characteristics are the primary determinants of the choice of an alternative over the rest of the alternatives. To estimate a multinomial logit model, suppose $Y$ is the dependent variable indicating sectoral choice of the farm households. That is, $Y_i = 0$ if the $i$th farm household has no outstanding formal, semiformal or informal loan; $Y_i = 1$ if it has only a formal loan; $Y_i = 2$ if only semiformal loan; and $Y_i = 3$ if only informal loan. The probability of a particular sectoral choice is therefore given by:

\[
Prob[Y = j] = p_{ij} = \frac{\exp(\beta_j x_i)}{1 + \sum_{k=0}^{3} \exp(\beta_k x_i)} \quad \text{where } j = 0, \ldots, 3
\]  

\[
Prob[Y = j] = p_{i0} = \frac{1}{1 + \sum_{k=0}^{3} \exp(\beta_k x_i)} \quad \text{for } j = 0
\]

which gives a set of probabilities for $j + 1$ choices for the $i$th farm household of $x_i$ characteristics, where $j = 0, \ldots, 3$.

Maximizing the probability that each household makes a correct borrowing decision, conditional on the set of observed farm household and loan characteristics gives the following log-likelihood function:

\[
LogL(\beta) = \sum_i \sum_{j} I_{ij} p_{ij}
\]  

where $I_{ij}$ is an indicator variable in the dataset taking a value of 1 if a farm household $i$ is in category $j$ and 0 otherwise. As Maddala (1983) shows, this log-likelihood function is globally concave, and the values of $\beta$ that maximize this function have the usual maximum likelihood estimator (MLE) properties (Ruud, 1983) and can be used in the computation of marginal effects of individual characteristics on the probability of a farmer's choice of a lender, holding all other variables constant at their mean values. The predicted probabilities are better interpreted using the marginal effects of the multinomial model (Greene, 2003; p.723), which is a change in the probability of a choice due to a unit change in the relevant explanatory variable. This follows from differentiation of equation (3) with respect to the explanatory variables:
\[ \frac{\partial p}{\partial x_i} = p_j(\beta_j - \sum_{k=0}^{3} p_k \beta_k) = p_j(\beta_j - \bar{\beta}) \quad (5) \]

where \( \bar{\beta} \) is a weighted average of the \( \beta_k \), for \( k = 0, \ldots, 3 \). It can be noted that the effect of a change in an explanatory variable on the probability that \( Y = j \) is nonlinear with respect to \( \beta_j \) and depends on the predicted probabilities for the other categories. The probabilities are computed for each category of the dependent variable, except the reference category. More conveniently, elasticity estimates are used to show percentage change of the probabilities of the dependent variables due to a percentage change in the continuous independent variables. For a dummy variable, the effect of a variable is computed as the difference in the predicted probabilities as the dummy switches between values of one and zero. Unlike the binary dependent variable models, which use direct or indirect \( R^2 \) as a goodness-of-fit measure (McFadden, 2001), the multinomial logit model requires a modified measure based on likelihood ratio statistic (Maddala, 1983; p. 39) given by

\[ Pseudo \ R^2 = \frac{L_u^{2/n} - L_r^{2/n}}{1 - L_r^{2/n}} \quad (6) \]

where \( L_u \) and \( L_r \) are the maximized values for the unrestricted and restricted likelihood functions, respectively, with sample of size \( n \).

3.2.1 Model variables and hypotheses

**Dependent variable:** The explained variable is unordered sectoral choice, taking discrete values of 0 to 3, reflecting the sectoral categories described earlier.

**Independent variables:** Based on the conceptual arguments in section 3.1 and reviewed literature in section 2 above, a number of household and loan/lender characteristics were included in the model. Household characteristics include: age, gender, education level, extension visit, access to credit information and religious belief of the head of the farm household, household labour, dependency ratio, farm income, nonfarm income, saving, farm size, and household assets. Loan/lender variables include: loan size, interest rate, loan processing time, lender-borrower distance, flexibility of repayment schedule and type of credit (cash or in-kind). Definitions and expected effects of the variables on the choice probabilities are briefly discussed as follows.

**Household characteristics**

\( AGEH \) is age of a farm household head in years, used as a proxy for farm experience. Farmers develop and accumulate experiences including farm financing.
over time. With experience, farmers may improve their productive efficiencies, learn how to increase income generating capacities and strategies to cope with income shocks, one of which is borrowing. Borrowing experience may lead to choice of cheaper sources of credit. \textit{AGEH} is expected to have a positive effect on the choice probability of the formal sector (which is the cheapest in terms of interest rate), and a negative effect on the choice of the others.

\textit{EDUCL} is education level, referring to the number of years of formal schooling of the farm household head. The well-known Schulz hypothesis is that education increases “the ability to perceive, interpret, and respond to new events” (Schultz, 1981; p. 25). Skilled farmers are more likely to search for alternative sources of credit, compare costs and benefits of different sectors and select the best one more rationally. Hence, \textit{EDUCL} is expected to have a positive effect in the formal sector (which has lower lending rate), and a negative effect in others.

\textit{GENDER} is a dummy taking value 1 if the respondent is male and 0 otherwise. It is included to see if there are variations in credit sector choice due to gender differences.

\textit{RELGN} is a dummy taking value 1 if the respondent is a Muslim and zero otherwise. Ethiopian population comprises about equal proportions of followers of Islam and Christianity. There could be religious reasons for some farm households not to choose a source charging interest rates, and perhaps prefer informal arrangement in which there could be non-interest compensation for the loan. For example, in Islamic belief charging interest rates (or ‘riba’) is prohibited (Naser et al., 1999). Hence, Muslims are more likely to prefer informal sources, which may not charge interest rates, than the formal or semiformal sources that usually charge interest rates.

\textit{HLABOR} is household labour force consisting economically active (10 to 65 years old) members of a farm household. Household labour supply to the farm and/or non-farm economic activities increases creditworthiness of the farm households and thus a positive effect is expected in all sectors.

\textit{DEPRATIO} refers to dependency ratio, i.e., the ratio of household members of ages below 10 and above 65 years to the household size. Consumption increases with the size of the dependents in a household (Modigliani, 1986). Thus, it is expected to have a negative relationship with formal sector (since it has no consumption credit) and a positive with the others (which possibly support consumer credit).

\textit{FARMSZ} is farm size measuring total acreage operated by the farm household (in hectare), including farmland owned, rented in, and contracted in. In Ethiopia, formal lenders do not accept rural land as a collateral due to farmers’ lack of legal land property rights, although they have use rights. However, informal lenders may accept land as collateral because of their physical proximity to a borrower and that it may possibly agree informally with the borrower to use the land in case of default. Therefore, it is expected to have no effect on the formal and semiformal sectors but a positive effect in the informal credit sector.

\textit{FASSETS} is farm assets including farm implements, machineries and other farm stocks. Wealthier farmers are expected to own more assets, and they have the
potential for lumpy investments, which can generate more income, making own financing possible. However, if internal finance falls short of total financial requirement, more farm assets can increase the probability of obtaining external finance by raising borrowers’ creditworthiness. Like farmland, formal lenders do not also accept farm assets as collateral. Therefore, FASSETS is expected to have no effect on formal and semiformal sectors but a positive effect on informal sector.

FINCOME is farm income derived from farm outputs, including crop and livestock products and by-products, measured at market values. As the majority of farm households generate income from farm production, with increased farm income, farmers are more likely to afford to search for cheaper sources of finance, for they can also afford fixed costs. Hence they are more likely (positive effect) to prefer the formal sources – with lower interest rates – than the other sources (thus with negative effect).

NFINCOME is non-farm income derived outside of own farms such as casual employment, rentals of oxen, pack animals and land, handicrafts and petty trade. Nonfarm income is relatively smaller and transitory in nature than farm income, attributed partly to relatively scarce non-farm jobs in the study areas. Those with more NFINCOME may be more likely to borrow small but frequent loans, which may be costly for them to search for distant sources. Thus, they are more likely to borrow from nearby informal or semiformal sources.

SAVING is amount of saving during the reference year prior to the survey. Demand for credit decreases with savings, thus a negative effect in all cases is hypothesized.

Loan characteristics

CASHKIND is a dummy for type of loan, taking value 1 if the loan is obtained in cash and 0 if in kind. Often, formal credit for farm inputs is offered in kind in the form of chemical fertilizers, improved seeds, herbicides and pesticides. Therefore, this variable is expected to affect positively the probability to choose informal and semiformal and negatively that of the formal credit sector.

LOANSZ is loan size, which refers to the amount of credit obtained by a farm household. Debt service increases with loan size, but unit transaction cost may decrease with loan size, due to economies of size. The smaller the size of the credit demanded, the higher will be the unit transaction cost of borrowing, and the more likely the borrower searches for lenders with lower transaction costs. Although the formal sector charges lower interest rate, because of its distant locations and lengthy loan processing procedures, it may have relatively higher transaction costs compared to the other sectors. Thus, loan size is expected to correlate negatively with the formal but positively with the other sectors.

INTRATE is a lending interest rate (in percent), which is the direct cost to a borrower. Debt service increases with interest rate of the loan by increasing the amount of deductibles from borrower’s gross margin, which lowers net benefit from the credit. Hence, ceteris paribus, farmers are more likely to prefer credit sources with lower interest rates to those with higher rates. As can be seen from the
descriptive results in Table II, the formal sector has lower average interest rate than the other two sectors. Unless other factors such as transaction costs outweigh in borrowing decisions, the probability of choosing the formal sector over the others is expected to be higher because of the lower interest rates.

*LOANTIME* is the time (in weeks) a borrower has to wait until it obtains the loan since application. This duration varies among different lenders. The formal sector is the slowest sector compared to the other two. *Ceteris paribus*, the shorter the duration, the more attractive the sector for a borrower. Thus, *LOANTIME* is expected to have a negative relationship with the formal sector and a positive with the other two sectors.

*DISTRAVL* is lender-to-borrower distance (in kilometres). The longer the distance between the borrower and a lender, the higher the transportation cost incurred and the less attractive the source to the borrower, and the more likely the borrower opts for closer lending source, *ceteris paribus*. Thus, *DISTRAVL* is expected to have a negative effect on the probability of choosing a formal sector and positive effects on that of the semiformal and informal sectors.

*REPAYD* is a dummy for loan repayment flexibility, taking value 1 if the debt repayment could be rescheduled under certain reasonable conditions and 0 if not. As farm production is seasonal and weather dependent, so is farm income. When farm income falls short of the repayment commitment, the borrower may be forced to reschedule the debt repayment with possible costs carried forward. Some lenders may be flexible to allow this with costs appropriately borne while others may have fixed repayment system. Informal lenders may be easier for farm households to negotiate with (Pal, 2002), and therefore *REPAYD* is expected to have a positive relationship with the informal credit sector and a negative with others.

### 4. Data

The data were collected in a farm household survey conducted from September 2004 to January 2005 in Merti and Adamitullu-Jido-Kombolcha (AJK) districts in Oromia region, southeastern Ethiopia. These districts, located at about 200 km and 160 km, respectively, to the southeast of the capital, Addis Ababa (Finfinne), were purposely selected to represent the relatively diverse physical, socioeconomic and infrastructural characteristics of the sub-region. In these two districts, six Farmers Associations (FAs) – four from Merti district and two from AJK district – were selected based on their representativeness in terms of their distance to formal financial institutions. Using FA-level list of heads of farm households as a sampling frame, 240 sample farm household heads were randomly selected. Trained survey enumerators interviewed farm household heads using a structured questionnaire and by visiting them at their farmsteads. Individual visits were used to minimize external noise that might affect respondent's behaviour in answering sensitive questions such as income and loans, and to reduce nonresponse rate since the interviewer and the respondent directly talk to each other, possibly clarifying any misunderstandings in the questions asked.
Formal financial institutions are thinly distributed in the study areas. In AJK district, there were four commercial banks, one insurance company, two nongovernmental organizations (NGOs) (also engaged in credit service), a cooperative union, and a branch of microfinance finance institution. In Merti district, there were three service cooperatives, one commercial bank, one cooperative union and two NGOs partly engaged in credit delivery (OESPO, 2003). Moreover, infrastructural and informational infrastructure were very poor, especially in Merti district. These can pose considerable challenge to farm households in searching for different credit sources located farther. Information on relevant household demographic and socioeconomic characteristics expected to affect farm household decision-making were collected from heads of farm households. Although only the heads of farm households were interviewed, they were asked to provide information on all members of the households. Accordingly, the heads of farm households were asked whether the household had borrowed during the year preceding the survey, the amount borrowed and actual sources of credit. In addition, information such as distance to the lender, interest rates charged, type of credit obtained, repayment arrangements and possible defaults were also obtained.

The descriptive statistics for the full sample and stratified by credit sectors are shown in Table II. First, some variables of interest are highlighted for the full sample reported in the last column of Table II. A sample farm household head was 43 years old and attended four years of formal education. Household size was about eight persons, of whom four were in productive age and the rest were dependents at home or in school. The farm household cultivated about 1.8 hectares of farmland and owned assets with market value of about 14,634 Birr\(^*\), on average. The farm household earned average annual income of Birr 11,759 and Birr 359 from farm and non-farm sources, respectively, and of this, it saved about 4,641 Birr in financial and physical assets.

The survey shows that about 55% of the farm households borrowed from formal, semiformal or informal credit sources in the year preceding the survey. Of those who borrowed during the period, 49.62% borrowed from the informal credit sector, 28.57% from the formal sector and the remaining 21.8% from the semiformal sector. The main reason that the semiformal sector was the least of the sources from which the farm households could borrow was that this sector is often community based, member owned and less open for borrowers other than its members.

\(^*\) Ethiopian currency with exchange value of USS 1 = 8.80 Birr (Feb, 2007)
Table II: Sample mean and standard deviation by credit sector and for pooled data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>( Y_0 )</th>
<th>( Y_1 )</th>
<th>( Y_2 )</th>
<th>( Y_3 )</th>
<th>( Y_p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGEH</td>
<td>Age of household head in years</td>
<td>44.38</td>
<td>42.43</td>
<td>41.17</td>
<td>42.81</td>
<td>43.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(15.8)</td>
<td>(12.2)</td>
<td>(12.4)</td>
<td>(13.2)</td>
<td>(14.1)</td>
</tr>
<tr>
<td>Educl</td>
<td>Years of schooling</td>
<td>3.25</td>
<td>3.84</td>
<td>3.93</td>
<td>3.21</td>
<td>3.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.8)</td>
<td>(3.3)</td>
<td>(3.88)</td>
<td>(3.6)</td>
<td>(3.7)</td>
</tr>
<tr>
<td>HHSZ</td>
<td>Household size</td>
<td>7.14</td>
<td>9.16</td>
<td>9.34</td>
<td>7.74</td>
<td>7.89</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.4)</td>
<td>(3.7)</td>
<td>(4.9)</td>
<td>(3.3)</td>
<td>(3.7)</td>
</tr>
<tr>
<td>Hlabor</td>
<td>Household members 10-65 years old</td>
<td>3.80</td>
<td>5.42</td>
<td>4.69</td>
<td>4.55</td>
<td>4.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.0)</td>
<td>(2.5)</td>
<td>(3.3)</td>
<td>(2.7)</td>
<td>(2.5)</td>
</tr>
<tr>
<td>Depratio</td>
<td>Ratio of dependents to household size</td>
<td>0.43</td>
<td>0.43</td>
<td>0.49</td>
<td>0.45</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.2)</td>
<td>(0.2)</td>
<td>(0.2)</td>
<td>(0.2)</td>
<td>(0.2)</td>
</tr>
<tr>
<td>Farmsz</td>
<td>Farm size in hectare (ha)</td>
<td>1.57</td>
<td>2.52</td>
<td>2.11</td>
<td>1.63</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.2)</td>
<td>(1.1)</td>
<td>(1.2)</td>
<td>(1.2)</td>
<td>(1.2)</td>
</tr>
<tr>
<td>Fincome</td>
<td>Farm income in '00 Birr</td>
<td>153.45</td>
<td>62.01</td>
<td>80.41</td>
<td>107.77</td>
<td>117.59</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(145.6)</td>
<td>(51.5)</td>
<td>(71.7)</td>
<td>(116.6)</td>
<td>(123.9)</td>
</tr>
<tr>
<td>Nfincome</td>
<td>Nonfarm income in '00 Birr</td>
<td>4.53</td>
<td>3.48</td>
<td>2.73</td>
<td>2.54</td>
<td>3.59</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(11.1)</td>
<td>(7.8)</td>
<td>(5.5)</td>
<td>(7.1)</td>
<td>(9.1)</td>
</tr>
<tr>
<td>Fasset</td>
<td>Household assets in '00 Birr</td>
<td>185.02</td>
<td>104.89</td>
<td>109.68</td>
<td>124.24</td>
<td>146.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(171.8)</td>
<td>(74.9)</td>
<td>(85.5)</td>
<td>(90.3)</td>
<td>(134.8)</td>
</tr>
<tr>
<td>Distrave</td>
<td>Lender-borrower distance in Km</td>
<td>-</td>
<td>4.58</td>
<td>0.78</td>
<td>6.26</td>
<td>2.97</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(4.2)</td>
<td>(1.4)</td>
<td>(10.7)</td>
<td>(6.6)</td>
</tr>
<tr>
<td>Saving</td>
<td>Household annual saving in '00 Birr</td>
<td>59.91</td>
<td>20.70</td>
<td>34.92</td>
<td>44.24</td>
<td>46.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(58.9)</td>
<td>(26.5)</td>
<td>(31.9)</td>
<td>(54.7)</td>
<td>(52.8)</td>
</tr>
<tr>
<td>Loansz</td>
<td>Amount of loan obtained in Birr</td>
<td>-</td>
<td>822.12</td>
<td>457.48</td>
<td>441.37</td>
<td>307.08</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(832.1)</td>
<td>(386.1)</td>
<td>(663.3)</td>
<td>(579.6)</td>
</tr>
<tr>
<td>Inrate</td>
<td>Annual rate of interest in percent</td>
<td>-</td>
<td>11.12</td>
<td>37.97</td>
<td>38.54</td>
<td>17.22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1.52)</td>
<td>(31.8)</td>
<td>(50.8)</td>
<td>(34.1)</td>
</tr>
<tr>
<td>Loantim</td>
<td>Loan processing time in weeks</td>
<td>-</td>
<td>8.84</td>
<td>1.07</td>
<td>5.44</td>
<td>3.62</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(9.6)</td>
<td>(3.7)</td>
<td>(8.3)</td>
<td>(7.1)</td>
</tr>
<tr>
<td>Gender</td>
<td>=1 if household head is male; else 0</td>
<td>0.83</td>
<td>0.95</td>
<td>1.09</td>
<td>0.93</td>
<td>0.90</td>
</tr>
<tr>
<td>Relgn</td>
<td>=1 if household head is Muslim; else 0</td>
<td>0.62</td>
<td>0.65</td>
<td>0.83</td>
<td>0.69</td>
<td>0.67</td>
</tr>
<tr>
<td>Csrinfo</td>
<td>=1 if household has credit source information; else 0</td>
<td>0.81</td>
<td>1</td>
<td>0.76</td>
<td>0.89</td>
<td>0.86</td>
</tr>
<tr>
<td>Fexvisit</td>
<td>=1 if household head visited extension office; else 0</td>
<td>0.10</td>
<td>0.55</td>
<td>0.59</td>
<td>0.70</td>
<td>0.40</td>
</tr>
<tr>
<td>Repayd</td>
<td>=1 if debt repayment is flexible; else 0</td>
<td>-</td>
<td>0.25</td>
<td>0.38</td>
<td>0.44</td>
<td>0.40</td>
</tr>
<tr>
<td>Cashkind</td>
<td>=1 if cash loans; else 0</td>
<td>-</td>
<td>0</td>
<td>0.45</td>
<td>0.94</td>
<td>0.62</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td>107</td>
<td>38</td>
<td>29</td>
<td>66</td>
<td>240</td>
</tr>
</tbody>
</table>

**Note:** \( Y_0 = \) no loan, \( Y_1 = \) formal, \( Y_2 = \) semiformal, \( Y_3 = \) informal, \( Y_p = \) Pooled sample; figures in brackets are standard deviations of the means.

**Source:** Author's own survey (2004/5)

16
There was considerable difference in the interest rates among the three sectors. The highest (38.54%) was in the informal sector and the lowest (11.12%) in the formal sector. The loan processing time was different among the sectors; on average, it took about nine weeks in the formal sector to obtain a loan since application whereas about one week in the semiformal and five weeks in informal sector. The possible reasons for the slowest loan processing in the formal sector were that credit applications in this sector are reviewed at different administrative levels – farmers’ association, district and zonal offices; that the loans are delivered in kind such as fertilizers, seeds, herbicides and pesticides, organizing and transporting of which require relatively longer time than a cash loan would take. In contrast, 94% of the loans obtained from the informal credit sector were in cash, thus required shorter loan processing time. This suggests that the type of credit can be one factor affecting the speed of credit delivery, for it is faster to transfer money than goods. Moreover, in the study areas, only a few of the formal sector lenders had branches at a district level and branches were located in urban centres. Transportation and other transaction costs increase with the borrower-lender distance. This might have contributed to the observed delays in loan processing time in the formal sector, given the underdeveloped transportation and communications infrastructure in rural areas. However, because the farm inputs are transported to the borrowers’ locations in large volumes under organized procurement and transportation system, this possibly cuts unit costs due to economies of scale.

Farm households who borrowed from the informal sector had the highest farm income on average but the lowest nonfarm income. Those who borrowed from the formal sector had larger farm size and nonfarm income but lower farm income, farm assets and household saving than those who borrowed either from semiformal or informal sectors. The fact that those who had formal loans were those who operate large farms was likely because the FA administration selects credit applicants with larger farms when they submit their credit applications to the district input loan coordination unit, which reviews aggregate applications coming from different FAs. It might also be related to the ‘quota’ rationing system in the formal input credit supply, which effectively might ration out the smallholders, as the farm size was an important factor in borrowing farm inputs from the formal credit sector. Average loan size was the highest for those who borrowed from the formal sector, followed by that from the informal sector, but borrowing interest rates were inversely related to the loan size. The formal credit sector exhibited the longest loan processing time, less flexible repayment arrangement and offers credit predominantly in kind.

Farm households who borrowed from the formal and semiformal sectors were predominantly male-headed, younger, more educated, and had more family labour and household size but comprised less dependents and proportion of Muslims. Those who borrowed from the formal sector had more credit information but relatively less extension visits than those who borrowed from the other sectors. This suggests that those who are female-headed, older, less educated, with limited family labour (or more dependents), uninformed on credit sources, Muslims, and smallholders are less likely to borrow from the formal sector. However, since these descriptive statistics are unconditional univariate averages, it is imperative to
investigate the relationships further by controlling for different factors in an econometric framework, which is presented in the next section.

5. Results and discussion

5.1 Predicted probabilities

As shown in Table III, the econometric model estimates conditional choice probabilities of 0.3167, 0.1667 and 0.5167 for formal, semiformal and informal credit sectors, respectively. This shows that the informal credit sector dominates the Ethiopian rural financial market, regardless of the financial sector reform that envisaged expansion of formal credit market to rural areas.

Table III: Actual and predicted frequencies of sectoral choice

<table>
<thead>
<tr>
<th>No loan</th>
<th>Formal</th>
<th>Semiformal</th>
<th>Informal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freq.</td>
<td>%</td>
<td>Freq.</td>
<td>%</td>
</tr>
<tr>
<td>Observed</td>
<td>107</td>
<td>44.58</td>
<td>38</td>
</tr>
<tr>
<td>Observed</td>
<td></td>
<td>28.57</td>
<td>21.80</td>
</tr>
<tr>
<td>Predicted</td>
<td>120</td>
<td>50.00</td>
<td>38</td>
</tr>
<tr>
<td>Predicted</td>
<td>31.67</td>
<td>16.67</td>
<td>16.67</td>
</tr>
</tbody>
</table>

Note: a, b computed for the subsamples, i.e., the frequencies of the three sectors were divided by 133 in the second row and by 120 in the fourth row.

Source: Author’s own survey result (2004/5) and estimated model output

Maximum likelihood estimates of the parameters of the credit sector choice probabilities are reported in table IV. Based on the likelihood ratio test, the model performed well at less than 1% significance level. As reported in Table IV, the alternative “no outstanding loan” was used as a benchmark alternative so that the coefficient estimates are the logarithm of the odds of formal, semiformal or informal sectors over this benchmark alternative. A positive estimated coefficient of a variable indicates increase in the likelihood of choosing a particular credit sector, and vice versa for a negative coefficient. The effect of any variable on choice probabilities derives from the difference in the indirect utilities across the different alternatives, as shown in equation (2). This means that the positive (negative) coefficient measures the relative superiority (inferiority) of the chosen alternative compared to the other alternatives in terms of the derived indirect utilities. More conveniently, the effects of specific household and loan characteristics on the choice probabilities are discussed using the estimated marginal effects and elasticities, as reported in Table V.

5.2 Effects of household characteristics

Factors that significantly affected the choice probabilities are discussed based on the estimated coefficients in Table IV and the marginal effects and elasticities in Table V. Accordingly, the probability of choosing the formal credit sector was positively affected by GENDER, EDUCL, HLABOR, FARMSZ, CRSRINFO and
Education, credit information and extension visit are more likely to increase the information base and decision-making abilities of the farm households including the ability to compare pros and cons of choosing appropriate credit source and production technology. This finding is in agreement with the well-known Schultz hypothesis (Schultz, 1981) and related to Asfaw and Admassie’s (2004) study which finds important role of education in adoption of chemical fertilizers.

In the study area, credit from the formal sector is predominantly in terms of agricultural inputs, often linked to extension service, which also promotes adoption of improved agricultural production technologies packaged with labour-intensive use of the inputs extended as credit. The use of the extension package, in effect, requires adequate labour supply (the farm household being the main source of farm labour supply), thus a positive effect of household labour on the choice of the formal credit for the farm inputs. The negative effect of the dependency ratio results from the inverse relationship of dependents to family labour supply because dependents (i.e., small children and the elderly) demand labour for their caretaking (i.e., a consumption labour) that will reduce labour supply of the working members of the households. Thus, the choice of the formal sector increases with the number of productive members of the farm household but decreases with number of dependents. Since formal lenders are located at distant urban centres, a farm household should be able to travel to these centres to secure the loan, however, those with more dependents are less likely to do so because the travelling time, among other costs of transaction, competes with household labour required to take care of the dependents (Roberts and Hannig, 1998).

The negative effect of the nonfarm income on the choice probability of the formal credit sector might relate to nonfarm labour supply, which increases nonfarm income but decreases with farm labour supply. The indirect negative effect on farm labour supply in turn relates to formal farm inputs credit. In magnitude, e.g., for a percentage increase in the household labour supply, the probability of choosing the formal credit sector increases by 1.34% (Table V). This suggests that an expansion of the formal credit sector would be more likely to succeed in relatively labour-abundant than in labour-scarce rural areas.

The probability of choosing the informal credit sector was affected positively by AGEH, RELGN, HLABOR and FEXVISIT, and negatively affected by GENDER, NFINCONE, SAVING, and CRSRINFO at reasonable significance levels. A peculiar result here is the effect of the religion dummy, which showed significant positive effect in the choice of informal sector but no effect in others. It means that, ceteris paribus, being a Muslim increases the likelihood of borrowing from the informal credit source. This is more likely because of the fact that Islamic belief prohibits charging interest rates (Gobezie, 2005; Naser et al., 1999). The informal sources are preferred as there are some (such as friends and relatives), which may not charge interest rates, but would work through other forms of compensatory mechanisms such as reciprocal labour or output supply to the lender at times other than when the loan was obtained.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Formal Coefficient</th>
<th>Semi-formal Coefficient</th>
<th>Informal Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Household characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGEH</td>
<td>-0.031 (-1.38)</td>
<td>-0.094 (-3.01)***</td>
<td>0.057 (2.81)***</td>
</tr>
<tr>
<td>GENDER</td>
<td>1.407 (2.67)***</td>
<td>2.984 (1.67)*</td>
<td>-2.817 (-2.70)***</td>
</tr>
<tr>
<td>RLGN</td>
<td>0.758 (1.04)</td>
<td>-2.042 (-1.49)</td>
<td>0.808 (2.46)***</td>
</tr>
<tr>
<td>EDUCL</td>
<td>0.183 (2.00)**</td>
<td>0.066 (0.63)</td>
<td>-0.044 (-0.61)</td>
</tr>
<tr>
<td>HLABOR</td>
<td>0.484 (3.33)***</td>
<td>0.592 (3.44)***</td>
<td>0.280 (2.14)**</td>
</tr>
<tr>
<td>FINCOME</td>
<td>-0.017 (-1.26)</td>
<td>-0.019 (-2.39)***</td>
<td>-0.022 (-0.08)</td>
</tr>
<tr>
<td>NFINCONE</td>
<td>-0.072 (-1.75)*</td>
<td>-0.005 (-0.15)</td>
<td>-0.053 (-1.85)*</td>
</tr>
<tr>
<td>DEPNDR</td>
<td>-3.971 (-2.02)**</td>
<td>-1.591 (-0.76)</td>
<td>-0.613 (-0.40)</td>
</tr>
<tr>
<td>HASSETS</td>
<td>-0.002 (-2.55)**</td>
<td>-0.051 (-0.74)</td>
<td>-0.043 (-1.40)</td>
</tr>
<tr>
<td>FARMSZ</td>
<td>0.624 (2.00)**</td>
<td>0.196 (0.76)</td>
<td>-0.034 (-0.15)</td>
</tr>
<tr>
<td>SAVING</td>
<td>-0.012 (-1.48)</td>
<td>-0.043 (-3.17)***</td>
<td>-0.024 (-3.52)***</td>
</tr>
<tr>
<td>CRSRINFO</td>
<td>0.395 (2.52)**</td>
<td>0.167 (2.13)**</td>
<td>-0.211 (-2.30)**</td>
</tr>
<tr>
<td>FEXVISIT</td>
<td>2.756 (4.24)***</td>
<td>1.171 (1.54)</td>
<td>2.8628 (5.10)***</td>
</tr>
<tr>
<td><strong>Loan characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOANTIME</td>
<td>-0.121 (-0.50)</td>
<td>-0.539 (-3.69)***</td>
<td>-0.087 (-2.72)***</td>
</tr>
<tr>
<td>INTRATE</td>
<td>-0.049 (-2.49)**</td>
<td>-0.073 (-3.58)***</td>
<td>-0.048 (-2.66)**</td>
</tr>
<tr>
<td>DISTRAVL</td>
<td>-0.214 (-0.45)</td>
<td>-0.379 (-2.18)**</td>
<td>0.053 (0.49)</td>
</tr>
<tr>
<td>REPAYD</td>
<td>2.868 (1.47)</td>
<td>5.131 (2.91)***</td>
<td>4.339 (2.85)***</td>
</tr>
<tr>
<td>CASHKIND</td>
<td>-2.049 (-1.23)</td>
<td>3.314 (2.08)**</td>
<td>0.531 (2.44)**</td>
</tr>
<tr>
<td>LOANSZ</td>
<td>0.015 (0.27)</td>
<td>-0.018 (-1.84)*</td>
<td>-0.010 (-2.28)**</td>
</tr>
<tr>
<td>INTERCEPT</td>
<td>0.345 (2.15)**</td>
<td>0.274 (2.13)**</td>
<td>0.225 (2.21)**</td>
</tr>
<tr>
<td>N</td>
<td>38</td>
<td>29</td>
<td>66</td>
</tr>
</tbody>
</table>

**Notes:** The dependent variable is credit source; Log-likelihood function (unrestricted) = 156.82; restricted = -302.96; Likelihood ratio test: Chi-squared value (df = 54) = 292.29; P-value = 0.0000. N = 240; Pseudo-R² = 0.4824

"Category C0.0.0 is used as the benchmark alternative.

v Values in brackets are t-statistics.

\(^{\dagger}\) Statistical significance at 1, 5 and 10 percent levels are denoted by ***, **, and *, respectively."
Table V: MNL marginal effect coefficients and elasticities

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Household characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGEH</td>
<td>0.0136</td>
<td>1.25</td>
<td>-0.0002</td>
<td>-0.10</td>
</tr>
<tr>
<td></td>
<td>(2.95)***</td>
<td>(0.12)</td>
<td>(-1.66)*</td>
<td></td>
</tr>
<tr>
<td>GENDER</td>
<td>-0.5129</td>
<td>-0.98</td>
<td>0.2398</td>
<td>2.24</td>
</tr>
<tr>
<td></td>
<td>(-2.23)**</td>
<td>(1.83)*</td>
<td>(2.12)**</td>
<td></td>
</tr>
<tr>
<td>RLGN</td>
<td>0.1481</td>
<td>0.21</td>
<td>0.1030</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>(1.17)</td>
<td>(1.42)</td>
<td>(-1.56)</td>
<td></td>
</tr>
<tr>
<td>EDUCL</td>
<td>-0.0010</td>
<td>-0.01</td>
<td>0.0174</td>
<td>0.62</td>
</tr>
<tr>
<td></td>
<td>(-0.06)</td>
<td>(1.70)*</td>
<td>(0.67)</td>
<td></td>
</tr>
<tr>
<td>HLAVOR</td>
<td>-0.0835</td>
<td>-0.77</td>
<td>0.0295</td>
<td>1.34</td>
</tr>
<tr>
<td></td>
<td>(-2.74)***</td>
<td>(2.75)***</td>
<td>(1.73)*</td>
<td></td>
</tr>
<tr>
<td>FINCOME</td>
<td>0.0006</td>
<td>0.16</td>
<td>-0.0006</td>
<td>-0.69</td>
</tr>
<tr>
<td></td>
<td>(0.96)</td>
<td>(-1.09)</td>
<td>(-1.69)*</td>
<td></td>
</tr>
<tr>
<td>NFINCOME</td>
<td>0.0133</td>
<td>0.10</td>
<td>-0.0042</td>
<td>-0.16</td>
</tr>
<tr>
<td></td>
<td>(2.02)**</td>
<td>(-1.09)</td>
<td>(1.74)*</td>
<td></td>
</tr>
<tr>
<td>DEPNDR</td>
<td>0.3188</td>
<td>0.38</td>
<td>-0.3167</td>
<td>-1.85</td>
</tr>
<tr>
<td></td>
<td>(0.92)</td>
<td>(-2.54)**</td>
<td>(-0.50)</td>
<td></td>
</tr>
<tr>
<td>HASSETS</td>
<td>0.0010</td>
<td>0.31</td>
<td>0.0010</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>(1.43)</td>
<td>(2.08)**</td>
<td>(-0.45)</td>
<td></td>
</tr>
<tr>
<td>FARMSZ</td>
<td>-0.0114</td>
<td>-0.04</td>
<td>0.0165</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>(-0.22)</td>
<td>(1.79)*</td>
<td>(1.54)</td>
<td></td>
</tr>
<tr>
<td>SAVING</td>
<td>0.0120</td>
<td>0.51</td>
<td>-0.0020</td>
<td>-0.06</td>
</tr>
<tr>
<td></td>
<td>(3.53)***</td>
<td>(-0.23)</td>
<td>(-1.83)*</td>
<td></td>
</tr>
<tr>
<td>CRSRINFO</td>
<td>0.0197</td>
<td>0.04</td>
<td>0.0420</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td>(0.12)</td>
<td>(2.65)***</td>
<td>(2.17)**</td>
<td></td>
</tr>
<tr>
<td>FEXVISIT</td>
<td>-0.6842</td>
<td>-0.57</td>
<td>0.1253</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>(-5.30)***</td>
<td>(1.68)*</td>
<td>(-0.44)</td>
<td></td>
</tr>
<tr>
<td><strong>Loan characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOANTIME</td>
<td>-0.0298</td>
<td>-0.23</td>
<td>-0.0056</td>
<td>-0.21</td>
</tr>
<tr>
<td></td>
<td>(-0.99)</td>
<td>(0.31)</td>
<td>(1.79)*</td>
<td></td>
</tr>
<tr>
<td>INTRATE</td>
<td>0.0123</td>
<td>0.80</td>
<td>-0.0022</td>
<td>-0.69</td>
</tr>
<tr>
<td></td>
<td>(2.85)***</td>
<td>(1.43)</td>
<td>(-1.53)</td>
<td></td>
</tr>
<tr>
<td>DISTRAVL</td>
<td>0.0051</td>
<td>0.03</td>
<td>-0.0195</td>
<td>-0.60</td>
</tr>
<tr>
<td></td>
<td>(0.16)</td>
<td>(-0.58)</td>
<td>(-2.66)**</td>
<td></td>
</tr>
<tr>
<td>REPAYD</td>
<td>-1.0260</td>
<td>-0.86</td>
<td>0.0664</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>(-2.76)***</td>
<td>(0.52)</td>
<td>(1.37)</td>
<td></td>
</tr>
<tr>
<td>CASHKIND</td>
<td>-0.2411</td>
<td>-0.16</td>
<td>-0.1477</td>
<td>-0.48</td>
</tr>
<tr>
<td></td>
<td>(-0.82)</td>
<td>(-1.06)</td>
<td>(2.46)**</td>
<td></td>
</tr>
<tr>
<td>LOANSZ</td>
<td>0.0050</td>
<td>0.13</td>
<td>0.0010</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>(1.23)</td>
<td>(0.95)</td>
<td>(2.17)**</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>107</td>
<td>38</td>
<td>29</td>
<td>66</td>
</tr>
</tbody>
</table>

Notes: The dependent variable is credit source, i.e., Y₀ = no loan, Y₁ = formal sector, Y₂ = semiformal sector, Y₃ = informal sector; Log-likelihood function: unrestricted = -156.82; restricted = -302.96; Likelihood ratio test: Chi-squared value (df = 54) = -292.29; P-value = 0.0000. N= 240; Pseudo-R² = 0.4824; Values in brackets are t-statistics. Statistical significance at 1%, 5% and 10% levels are denoted by ***, **, and *, respectively.
In a related study, Emana et al. (2005) also noted the significance of low or no interest rate on credits from friends and/or relatives in Ethiopia. It may also explain reciprocity in lending common in developing countries (e.g., Vogel and Burrett, 1986). In this connection, a study showed that in Ethiopia 29% of borrowers were related with lenders in labour sharing, 5% each with input marketing and oxen sharing and about 4% with crop output marketing arrangements (Mekonnen, 2002). This depicts important interlinkages between credit market and other rural markets even without directly charging interest rates on the loans.

The probability of choosing the semiformal credit sector was positively affected by GENDER, HLABOR and CRSRINFO whereas negatively affected by AGEH, FINCOME and SAVING at the conventional significance levels. Farm households, which are male-headed, with more household labour, and with credit information on different credit sources, were more likely to borrow from semiformal credit sector. The likelihood of borrowing from semiformal sector decreases as the age of the household head, farm income and household saving increase. For example, for a percentage increase in household saving, the probability to borrow from the semiformal sector decreases by 1.24% and the corresponding effects for age and farm income were 2.82% and 2.05%, respectively (Table V).

The positive effect of farm household’s visit to the extension office on the probability of borrowing from formal and informal credit sectors but no effect on that of the semiformal credit sector could be explained by the fact that the semiformal credit sector is limited to a specific community and members of particular institutions. That is, borrowing in these sectors is more likely to be influenced by inside factors of the institution to which the farm household belongs than external factors, which makes this sector less open for outsiders to borrow from. The formal and informal sector is external to the borrower and the probability of the farm household to choose these sectors is more likely to be affected by external factors such as borrower’ visit to extension office and information on credit sources. Informed farm households are more likely to choose semiformal and formal sources than uninformed farm households. By intuition, informed borrowers are more likely to choose the best sector in light of their circumstances and considering effective costs and benefits of borrowing. This is further supported by the positive effect of farmers’ visit of an extension office, where information on the formal credit sector could also be obtained from extension workers who give advisory services to the farm households on adoption of better production technologies, which, in turn, are also linked to formal agricultural input credit supply.

Looking across the three credit sectors, GENDER and HLABOR affected the choice probabilities of all sectors. AGEH has a positive effect on the probability of choosing the informal sector, a negative effect on that of the semiformal sector, and no effect on that of the formal sector. The age of the household head did not matter in the case of the formal credit sector possibly because formal credit applications normally exclude those who are not active members of the farmers’ associations (FAs) because of age limits but once he/she is a member, it is less likely that he/she will be denied credit on the basis of age. With increased age, the household might demand not only production credit but also consumption credit, often because of
increased household size. In this situation, such farm households are more likely to value the informal and semiformal sector than the formal sector, as the latter supplies only production loans. The elasticity estimates show that for a percentage increase in the age of a borrower the probability of choosing the informal sector increases by 1.22% while it decreases by 2.82% in the semiformal sector, respectively.

*EDUCL* affected the probability of choosing only the formal sector but not the other sectors. This implies that educated farm household heads are more likely to choose the formal sector. This is possibly because they also adopt improved production technologies, which require external inputs supplied through the formal credit sector. The low level of education of the farm households may have contributed for limited use of formal sector credit by farm households and thus the education level of farm households need to be raised to expand their use of formal credit. The variable *SAVING* affected the probability of choosing the semiformal and informal sectors. The variable *FINCOME* negatively affected the probability of choosing the semiformal sector, but not the other sectors. This suggests that those who borrow from the semiformal sector tend to be in a similar farm income category but borrow when experiencing a decline in farm income. As the semiformal credit sector is often community based and member owned, access to such credit is likely to be limited to only members of the institutions. Although the semiformal sector exhibits mutual help among its members, it likely to be affected by covariate risks affecting all members of the community (Boucher and Guirkinger, 2004).

Results also show that men tend to borrow more from the formal and semiformal credit sectors than women do. That is, being a female reduces the likelihood of borrowing from the formal and semiformal credit sectors whereas it increases the probability of borrowing from the informal credit source. This may also suggest the presence of the formal and semiformal sectors' bias against women-headed farm households. The descriptive results in Table II also show that those who borrowed from the formal and semiformal credit sectors were predominantly men. The Ethiopian family law stipulates that male is the legal head of a household, which also implies that men have more decision-making power than women. Under this condition, it is not surprising to see the formal and semiformal institutions bias against women, since they may be abiding by the law in entering into credit contracts. The less likelihood of women to borrow from the formal and the semiformal sectors is suggestive of the importance of legal relationships in their lending rules. This result can also reflect the fact that, in traditional society such as in Ethiopia, labour demand for taking care of the dependents is higher for women than for men, making the distant formal credit lender more expensive for women than for men so that the women were likely to choose the informal sector. This is further supported by the findings of Kocher (1997) and Chung (1995) where they argue that informal loans are relatively cheaper when noninterest costs are factored into accounts of total costs of borrowing.
5.3 Effects of loan characteristics

Farm household’s credit sectoral choice was affected not only by household characteristics but also by loan characteristics. Accordingly, the probability of borrowing from the formal sector was significantly negatively affected by \textit{INTRATE} while the other variables were statistically insignificant. The semiformal and informal credit sectors’ choices were significantly and positively affected by \textit{REPAYD} and \textit{CASHKIND} and negatively affected by \textit{LOANTIME} and \textit{INTRATE}. Moreover, the variable \textit{DISTRAVL} negatively affected the semiformal sector.

Across sectors, \textit{INTRATE} had negative effect on the choice probabilities of all sectors, as expected, but the marginal effect was not statistically significant for the formal and semiformal sector. The insignificance of the marginal effect of the interest rate in the formal sector might be due to the already low level of interest rate in the sector (Table II). The insignificance of the marginal effects of interest rate in the semiformal sector could be because of the sector’s limited credit access to nonmembers since membership in such institutions is often not open to everyone. In other words, membership might be more influential than the interest rate in determining access to credit from semiformal credit sector. In magnitude, a percentage increase in the interest rate decreases the probability of borrowing from the informal sector by about 0.67%, while it increases the probability of nonborrowing by 0.8%. The informal sector charges the highest interest rate (Table II) and a percentage increase will considerably raise the effective rate of interest charged, making the already expensive loan more expensive and thus less attractive to potential borrowers.

Although the formal credit sector charges the cheapest interest rate, only a small proportion of borrowers were able to borrow from the formal sector than from the informal sector. The fact that the majority of the farm households borrowed from the informal credit sector is in line with several previous studies (Emana et al., 2005; Buckley, 1997; WorldBank, 1989; p. 112). The insignificance of the marginal effects of interest rate for the formal and the semiformal sectors suggests that interest rate is less likely to influence the farm households’ borrowing decisions from these sectors. It also implies that factors other than the interest rate (such as those leading to rationing) are important in affecting farm households’ borrowing from this sector. This supports Bouman’s (1990) argument that informal sector’s low transaction costs can effectively reduce the otherwise nominally higher interest rates of the sectors which borrowers can account for in their borrowing decision to choose the informal credit sector. This result is also similar to Kochar’s (1997) and Chung’s (1995) arguments that informal loans are cheaper than the formal loans when noninterest costs are accounted into total costs of borrowing.

The negative effect of \textit{LOANTIME} on the probability of choosing the semiformal and informal sectors means that, \textit{ceteris paribus}, a farm household is more likely to choose the two sectors if it would like to obtain a loan at relatively shorter period of time. The formal sector was not significantly affected by loan processing time. Two possible reasons may be there. On the one hand, there is little variation in the loan processing time from the formal sector and thus all farm households might be equally affected. On the other hand, since formal sector loans are mostly in terms of
agricultural inputs (in which other sectors are less likely to compete), the formal sector has a considerable monopoly power, irrespective of its loan processing speed. Descriptive result in Table II also confirm that the formal sector had the slowest loan processing.

The negative effect of \textit{DISTRAVL} (the most distant being the formal sector) on the probability of borrowing from the semiformal sectors suggests that farm households are discouraged to borrow from this sector if it is located farther. This is because both temporal and monetary costs of transaction, especially transportation cost, increase with lender-borrower distance, which raises the effective cost of borrowing at otherwise relatively lower interest rate in the sector. This also confirms Kochar’s (1997) and Chung’s (1995) findings. The positive effect of \textit{REPAYD} on the choice probabilities of the informal and semiformal sectors indicates that farm households are more likely to prefer the informal and semiformal sectors to the formal sector with respect to flexibility in rescheduling loan repayments in times of unexpected income shocks. This is in line with Pal’s (2002) and Sinha and Matin’s (1998) findings which suggest that informal lenders are preferred for their local and timely access, speedy disbursement, flexible repayment, and easy or minimum bureaucratic procedures.

The positive effect of \textit{CASHKIND} on the probability of borrowing from both informal and semiformal sectors but a negative effect on that from the formal sector implies that when the farm households demand cash credit, the formal sector would be the least to be preferred. This corroborates the fact that the formal credits were supplied in kind as agricultural inputs. The negative effect of \textit{LOANSZ} on the semiformal and informal sectors implies that the probability of borrowing from these sectors decreases as loan size increases. This might be limited by inadequacy of loanable funds in these sectors. In the literature it is argued that informal lenders’ services are limited to local environments, few products, short-terms and vulnerable to covariate risks affecting all members of the local communities and limited by wealth constraints of the local economy (Gonzalez-Vega, 2003; Christensen, 1993; Carpenter and Jensen, 2002). A possible reason for the insignificance of \textit{LOANSZ} in the formal sector could be that in this sector, credit was limited to agricultural inputs and often the amount a farm household can borrow is fixed in a “quota” system, which is independent of the amount of credit actually demanded.

6. Conclusions and policy implications

There is an empirical gap in the literature in Sub-Saharan Africa in general, and in Ethiopia in particular, as to how farm household demographic and socioeconomic factors as well as loan characteristics affect farm household choice among formal, semiformal and informal sources of credit under imperfect financial market conditions. To bridge this gap, this study has estimated sectoral choice probabilities of farm households using rural household survey data and assessed household and loan/lender characteristics affecting their choice probabilities. The choice probabilities were estimated at 0.3167, 0.1667 and 0.5167 for formal, semiformal and informal credit sectors, respectively. The probability of choosing the formal
sector was positively affected by gender, education, household labour, farm size, credit information and extension visit of the farm households and negatively affected by nonfarm income, dependency ratio and interest rate. The probability of choosing the semiformal sector was positively affected by gender, household labour, credit information, flexibility of credit repayment and whether or not cash credit could be obtained and negatively affected by age, farm income, household saving, loan processing time, interest rate and lender-borrower distance. The probability of choosing the informal sector was positively affected by age, religion, education, extension visit, flexibility of credit repayment and whether or not cash credit can be obtained, and negatively affected by gender, nonfarm income, household saving, credit information, loan processing time and interest rate.

It is also found that the informal credit sector is the most dominant credit sector in the study areas. This is partly because formal and semiformal financial markets in Ethiopia are at low level of development, which is evident from the large differential in interest rates among the credit sectors, which resulted from low level of competition in the rural financial market. This observation concurs with the general belief that the informal sector holds the largest rural financial market share in developing countries (Guirkinger, 2005; Lipton, 1976).

The fact that the formal lending institutions in Ethiopia exhibit large excess reserves above levels legally warranted (IMF, 2006), although rural borrowers face credit constraints, suggests limited credit supply due to formal credit sector’s lending policies. The formal sector’s excess deposit reserve is suggestive of limited credit access to borrowers. The informal and semiformal sector often experience deficit of loanable funds, mainly because the informal sector is less likely to legitimately mobilize resources for on-lending purpose, and the semiformal is limited to only the resource base of its members. The gap between the formal sector’s excess reserves (coupled with its lower lending interest rate) and the semiformal and informal sectors’ higher lending rates, physical proximity to borrowers and its limited loanable funds suggest that there can be a tradable margin among the different sectors, which in effect can reduce the gap and thereby enhance rural financial intermediation. The informal sector is dependent on the local economy, susceptible to covariate risks, and unable to cater for large and long-term loans. This constrains its potential to satisfy farm households’ existing and potential demand for credit. Thus, the semiformal and formal financial sectors’ lending policies and instruments need to be more compatible with borrowing characteristics of the farm households. This possibly requires intersectoral linkages, particularly between formal and semiformal sectors, in light of the gaps mentioned above.

The fact that the majority of farm households chose the informal credit sector, although the informal credit sector exhibits higher interest rate, suggests that other factors than the interest rate were more important in affecting borrower’s choice among the credit sectors. This warrants consideration of factors other than the interest rate to expand the formal sector credit supply to the farm households. Among others, farmers’ education, credit information, extension visit as well as women participation, labour supply and farm size need to be improved. Loan characteristics also suggest that the farm households are more likely to be affected by the indirect costs associated with accessing the credit such as loan processing
time, type of loan, loan size, rather than by the direct cost of borrowing, i.e., the interest rate. Thus, the formal credit sector should improve factors that increase transaction costs to the farm households. For example, enhancing efficiency of loan provision to reduce delays in formal credit supply, making loan repayment system flexible and commensurate with farm households’ income flows and allowing farm households to have cash and in-kind credit options may enhance formal sector credit supply to the farm households. In general, the formal sector requires further innovations in financial products and instruments to accommodate the borrowing characteristics of the majority of smallholder farm households.

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References


Influence of credit constraint on technical efficiency of farm households in Southeastern Ethiopia

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Abstract

Credit constraint not only affects the purchasing power of farmers to procure farm inputs and cover operating costs in the short run, but also their capacity to make farm-related investments as well as risk behaviour in technology choice and adoption. These, in turn, have influence on technical efficiency of the farmers. Although credit constraint problem has been recognized in economics literature, especially in those dealing with developing countries, little emphasis has been given to its effect on productive efficiency of farmers. In light of this, explicitly considering credit constraint, this paper estimated technical efficiency of credit-constrained (CCFH) and unconstrained farm households (CUFH) by employing a stochastic frontier technique on farm household survey data from Southeastern Ethiopia. The CCFH had mean technical efficiency score of 12% less than that of the CUFH. Given the largest proportion of CCFH in Ethiopian farming population, this gap implies considerable potential loss in output due to inefficient production. Improving technical efficiency of all farm households in general but more of particularly the CCFH is desirable. Additional sources of inefficiency differential between the two groups were also identified, and education level of household heads, land fragmentation and loan size significantly affected technical efficiencies of both groups. Besides, wealth and experience affected the CCFH, and household size affected the CUFH. In general, the results have important implications for credit, education and land policies in developing countries.

Keywords: Credit market, stochastic frontier, technical efficiency, smallholders.

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1. Introduction

Credit is one of the components of financial services considered fundamental in all production circuits and networks – material and service products (Dicken, 2007). However, theories of production and finance developed along separate paths as if production and financial decisions could be precisely separated (Blancard et al., 2006), with little focus on their interactions. Recently, there has been a growing interest in understanding the impact of financial structure on production (e.g., Barry and Robinson, 2001). In some technical efficiency studies, production inputs and corresponding prices are assumed constant, which means that technical efficiency is independent of input use (Alvarez and Arias, 2004; Färe et al., 1990; Lee and Chambers, 1986; Farrell, 1957). Among others, this unrealistic assumption precludes the effect of technical efficiency on input demands (Alvarez and Arias, 2004) because it assumes away relative differences among producers in terms of resource endowments and possible constraints in acquiring additional inputs, which indirectly affect the capacity of producers to attain desired level of technical efficiency. In addition, short-term efficiency indices are estimated within a framework of a given production technology. This also ignores the fact that the capacity of farmers to choose appropriate and more efficient technologies can be constrained by bounds of their resources (e.g., Alene and Hassan, 2006), one of such bounds being credit constraints. However, it is a common knowledge that asymmetric information and incentive compatibility problems lead to capital market imperfections, which in turn bring about credit constraints faced by borrowers (Blancard et al., 2006; Stiglitz and Weiss, 1981). Given underdeveloped infrastructure, inadequate institutional environment, and less competitive market situation in developing countries, credit market imperfections are common phenomena. Of course, credit constraint is not only a problem of developing countries. As evidence from various studies (Blancard et al., 2006; Gloy et al., 2005; Jappelli, 1990; Tauer and Kaiser, 1988; Lee and Chambers, 1986) shows, farmers in developed countries, especially small farmers, also face credit constraints, since developed countries’ credit markets are yet not as perfect as often assumed in standard economic theories. For example, Blancard et al. (2006) observed that 67% of the farmers in their sample of 178 French farmers were financially constrained in the short run. In light of this, the presence of credit constraints is less debatable than its extent in the literature (e.g., Pal, 2002; Bali Swain, 2002; Kochar, 1997). This is mainly because access to credit market may not be translated automatically into one’s participation in the credit market, given considerable information asymmetry and incentive compatibility problems (Diagne and Zeller, 2001; Barry and Robinson, 2001), and taking loans may not also lead to automatic solution to credit constraints (Guirkinger and Boucher, 2005; Freeman et al., 1998). For example, Barry & Robinson (2001) argue that access to external financing resources being limited, farmers’ operations and investments heavily depend on internal financing. Farmers in developing countries are internally also constrained due to meagre resources they command.

As much as credit is fundamental to the operation of all production circuits and networks (Dicken, 2007), on the contrary, credit constraint can have direct and
indirect effects on, for example, farm production. Directly, it can affect the purchasing power of producers to procure farm inputs and finance operating expenses in the short run and to make farm-related investments in the long run; and indirectly, it can affect risk behaviour of producers (Guirkinger and Boucher, 2005; Eswaran and Kotwal, 1990), thereby affecting technology choice and adoption by farmers. In this connection, for example, Binswanger & Deininger (1997) argue that an unequal distribution of initial endowments in environments where financial markets are imperfect and credit is rationed can prevent a large proportion of the population from making productive investments. Thus, a credit-constrained farmer is more likely to invest in less risky and less productive rather than in more risky and more productive technologies (Dercon, 1996). This risk behaviour affects technical efficiency of the farmers, thereby limiting the effort of the farmer in attaining maximum possible output. The notion that a credit constraint influences agricultural production has long been observed in the literature (e.g., Blancard et al., 2006; Petrick, 2005; Barry and Robinson, 2001; Färe et al., 1990; Lee and Chambers, 1986); however, empirical studies of its influence on efficiency are generally limited, scarce in most developing countries and particularly lacking in Ethiopia. In particular, most previous efficiency studies in Ethiopia (Haji, 2007; Haji and Andersson, 2006; Alene and Hassan, 2006; Gavian and Ehui, 1999; Admassie, 1999; Hailu et al., 1998) used a dummy variable for access to credit, measuring whether or not farmers took credit in producing outputs. This implicitly assumes that farmers who obtained loans would have their effective credit demand satisfied and would become credit-unconstrained. Obviously, this will not disentangle the difference between borrowing status and credit constraint condition (Diagne and Zeller, 2001; Freeman et al., 1998). Using a dummy variable in this way can only allow capturing whether or not the farmer had access to a credit facility or had obtained the credit. It does not show whether access to credit satisfies effective credit demand and alleviates credit constraints of the farmers or not. For example, Freeman et al. (1998) noted absence of relationship between farmers’ borrowing and credit constraint status in Ethiopia, and suggested that significant proportion of those with some amount but inadequate loans still faced credit constraint in their economic activities. This also suggests that one needs to look into credit transactions and learn more from the borrowers in order to assess their credit constraint status (Boucher et al., 2005; Iqbal, 1986), and this paper used this approach.

In light of the preceding arguments, this study estimated technical efficiency of credit constrained (CCFH) and unconstrained farm households (CUFFH) by disaggregating the full sample on the basis of credit-constraint status of the farm households, and identified factors additionally affecting their technical efficiencies. Results indicate that the CCFH had mean technical efficiency score of 12% less than that of the CUFH. Given the largest proportion of CCFH in Ethiopian farming population, the gap is a considerable potential loss in output due to technical inefficiency, which the country cannot afford to ignore because of the food deficit problem it has currently faced. The result suggests that improving technical efficiency of all farm households in general and more of the CCFH in particular is desirable. Beyond the country in focus, i.e., Ethiopia, the results have important implications for credit, education, and land policies in developing countries, where
credit constraints are also widely observed. The rest of the paper is constructed as follows. Related theoretical and empirical literature is briefly reviewed in the next section. In section 3, the theoretical framework of technical efficiency is presented, followed by the empirical model in section 4. Describing the data in section 5, results and discussion are presented in section 6. Finally, conclusions and policy implications are suggested.

2. Credit constraint, access to credit market, and efficiency effect: review of literature

Credit market literature distinguishes between access to credit and participation in credit markets (e.g., Diagne and Zeller, 2001). A farm household has access to credit from a particular source if it is able to borrow from that source, whereas it participates in the credit market if it actually borrows from that source of credit. This implies that access to credit can be a constraint externally imposed on the farm households, while participation in a credit market is a choice made by a farm household. Thus, a household can have access but may choose not to participate in the credit market for such reasons as expected rate of return of the loan and/or risk consideration. In this connection, Eswaran & Kotwal (1990) argue that a non-participating household that has access to credit will still benefit if the knowledge of access increases its ability to bear risk, as it can be encouraged to experiment with riskier, but potentially high-yielding technology. The ability to borrow will also alleviate the need for accumulation of assets that mainly serve as precautionary savings, yielding poor or negative returns (Deaton, 1991).

Duca & Rosenthal (1993) argue that a farm household is credit constrained only when it would like to borrow more than lenders allow or if its preferred demand for credit exceeds the amount lenders are willing to supply. Stiglitz & Weiss (1992), on the other hand, describe credit constraints in two terms -- redlining and credit rationing. Redlining refers to excluding certain observationally distinct groups from credit markets, rather than offering them a contract that require higher interest payments and collateral guarantee. Credit rationing refers to a situation in which, among observationally identical borrowers, some get loans and others are denied.

Zeller et al. (1997) distinguish four groups of farm households in relation to credit constraints. The first, referred to as voluntary non-borrowers, are those who decline to borrow at will either because they have strong risk aversion and fear of getting into debt or because they are prudent and only would like to consume up to what they earn. Others who want to borrow less than their combined available credit lines from all lenders referred to as non-rationed borrowers. Rationed borrowers are those who want to borrow more than their available credit limit at a particular point in time. The last type of farm households, referred to as involuntary non-borrowers, are non-borrowers with no access to credit, or those who perceive that they are highly unlikely to get credit, so that the perceived borrowing costs outweigh the expected benefits of the loan.

On the supply side, quantity, transaction costs and risks are identified as relevant factors in the existing credit market literature (e.g., Feder, 1985; Foltz, 2004). First,
farm households are credit-constrained if they face a binding supply constraint as limited by lenders' considerations. Second, as lenders may pass on transaction costs associated with screening, monitoring, and enforcing loan contracts to borrowers, as in the case of group lending scheme (Besley and Coate, 1995), farmers with investments profitable when evaluated at the contractual interest rate may not be profitable when transaction costs are factored in. Thus, they may decide not to borrow but remain credit-constrained. Finally, for households with access to credit, risk may reduce loan demand and hence productivity. For example, Boucher et al. (2005) analytically show that in the presence of moral hazard lenders require borrowers to bear some contractual risk, and if this risk is sufficiently large, farmers will prefer not to borrow even though the loan would raise their productivity and expected income. Lenders assess creditworthiness of their clients based on observable characteristics (Bigsten et al., 2003), and extend loans at certain interest rate. This means that borrowers are credit-constrained if, at specific interest rate, they would have liked to borrow larger amount than the lender supplied. In this case, the borrower exhausts this supply and then looks for another lender. However, the fact that this borrower exhausts its supply from one source, at specific interest rate, makes it a risky borrower for another lender.

Credit markets in developing countries are inefficient due to market imperfections such as interest rate ceilings imposed by governments, monopoly power often exercised by informal lenders (Bell et al., 1997), large transaction costs incurred by borrowers in loan acquisition, and moral hazard problems (Carter, 1988; Carter and Weihe, 1990). Stiglitz & Weiss (1981) argue that the problem where the lender bears risk of the transaction and the borrower obtains project benefits can be seen as an information problem. The asymmetries of information in credit market imply that first-best credit allocation is not possible, and this leads to the need for partial or full collateral. Then, inadequate collateral or lack of it implies that some individuals are denied credit, being otherwise identical to those who have the collateral and obtain the credits. In this connection, Banerjee (2001) argues that high-income individuals can borrow large amounts at low costs whereas low-income ones are able to borrow a small amount at high cost. This suggests that income or wealth level of borrowers has a direct relationship with the amount of available credit and an inverse relationship with cost of credit.

Moreover, lenders may not be allowed legally to charge above certain limits on loans, although informal lenders in practice may do so, as, for example, Emana et al. (2005) noted in Ethiopia. If the lender is not allowed to charge an interest rate at which the expected return is positive, then there will be credit rationing. Even if allowed to do so, lenders may be affected by adverse selection and/or incentive problems so that the expected return on a loan may not monotonically increase with interest rate. That is, lenders may try to avoid selection and incentive problems by rationing credit.

In general, the theoretical literature above shows that credit market failures give rise to heterogeneous resource allocation and different outcomes among farm households with varying characteristics. That is, a farm household that faces a binding credit constraint, ceteris paribus, will misallocate its resources and under-invest compared to its unconstrained peer. Availability of finance and its
accessibility crucially affect production start-up and subsequent performances of the farmers. Barriers to access adequate loans will have adverse effect on technical efficiency of the farm households. Increased output production following improved access to credit is therefore evidence of binding credit constraint.

Most empirical literature reviewed below also support that credit constraints could affect resource allocations, risk behaviour and technology choice and adoption in production, which may lead to lower output of CCFH compared to the CUFH. For example, better access to credit resulted in higher income and consumption in Bangladesh (Diagne and Zeller, 2001) and in higher farm profitability in Cote d’Voire (Adesina and Djato, 1996), Malawi (Hazarika and Alwang, 2003) and in Tunisia (Foltz, 2004). Examining sources of efficiency differentials among basmati rice producers in the Punjab province of Pakistan, Ali & Flinn (1989) found significant effect of farmers’ access to credit and later Parikh et al. (1995) also found that farmers with greater loan uptake were less cost inefficient than those with smaller loan size. Another study in Pakistan by Khandker & Faruqee (2003) reported formal credit’s positive impact on household welfare outcomes. It was also found that formal credit increased rural income and productivity and that overall benefits exceeded costs of the formal credit system by about 13 percent in India (Binswanger and Khandker, 1995). Significant difference in productivities of credit-constrained and unconstrained households was observed in China (Feder et al., 1990; Feder et al., 1989). In Bangladesh, Pitt & Khandker (1996) examined the impact of credit from the Grameen Bank and other two targeted credit programs and found significant effects on household welfare, including education, labour supply and asset holding. Freeman et al. (1998) found that the marginal contribution of credit to milk productivity was different among credit-constrained and non-constrained farmers in east Africa.

More recently, studying the effect of credit constraints in Peruvian agriculture, Guirkinger & Boucher (2005) found that productivity of credit-constrained households depended on their endowments of productive assets and the credit they obtained from informal lenders. In Ethiopia, for example, Alene and Hassan (2006), studying the efficiency of traditional and hybrid maize production in eastern Ethiopia, found significant difference in farmers’ technical efficiency due to differences in technology choice. The hybrid maize technology required adoption of a package of improved seed, chemical fertilizers, and cultural practices that farmers did not equally adopt, resulting in low technical efficiency differential. Part of the reason for the farmers’ differential adoption of modern technology could be the credit constraints they face. Similarly, Holden & Bekele (2004) observed that households with access to credit compensated for increasing risk of drought by reallocating their production in such a way that crop sales were lower in good years to reduce the need to buy the crops in bad years. They argued that the households would be less able to do so without access to credit. Other efficiency studies in Ethiopia referred to earlier also identify access to credit as an important factor affecting efficiency of farmers.

It can also be seen that credit constraint is not only a problem of developing countries, where credit market imperfection is the norm rather than exception. The problem is present also in the developed world, where credit market imperfection is
considered significantly lower (Blancard et al., 2006; Jappelli, 1990; Färe et al., 1990; Tauer and Kaiser, 1988; e.g., Lee and Chambers, 1986). For example, Blancard et al. (2006), studying short- and long-run credit constraints in French agriculture (where 67% of 178 sample farms were financially constrained in the short-run and nearly all farms face investment constraints in the long run) found that financially unconstrained farms are larger in size and better in economic performance than financially constrained small farmers, resulting in a difference of about 8.34% in profit. However, the nature and extent of credit constraints in developed countries are significantly different from those in developing countries, where the imperfection is also prevalent in other factor markets.

In general, although credit is mostly identified as one of the socioeconomic factors affecting different outcomes such as farm productivity and profitability, household welfare, and so on, only few studies have directly focused on the effects of credit constraints on technical efficiencies. The recent paper by Blancard et al. (2006) is directly related to ours but since it focuses on developed economy, it cannot represent developing countries' conditions. The generally limited studies explicitly addressing the effect of credit constraints on technical efficiency suggest that more studies are still desirable.

3. Theoretical framework

In economic theory, it is often assumed that producers maximize revenue, minimize cost or maximize profit. However, not all producers are equally efficient in this process. Given the same inputs and technology, some produce more outputs, more efficiently than others do. In the literature, there are different methods of estimating efficiency. At a broader level, one can find parametric, semiparametric and nonparametric methods, based on whether or not one can assume a functional form for an underlying technology and a specific distribution for the error terms. In the parametric family, one can also find deterministic and stochastic efficiency measures depending on whether or not random terms are accounted for. The stochastic estimation techniques attribute observed deviations from the efficient frontier to inefficiency and random errors, while in deterministic models, the deviations are attributed solely to inefficiencies, despite that random errors are present.

Moreover, productive efficiency literature (Farrell, 1957; Aigner et al., 1977; Bravo-Ureta and Pinheiro, 1993; Sharma et al., 1999; Wadud, 2003) distinguishes between technical, allocative and economic efficiencies. In this paper, we focus on technical efficiency, explicitly taking into account the credit-constraint status of the farm households affecting input use as given. Technical efficiency is defined as the ability to avoid waste by producing as much output as input usage allows, or by using as little input as output production allows (Farrell, 1957).
This study makes use of stochastic frontier analysis (SFA), which requires a parametric representation of the production technology and incorporates stochastic output variability by means of a composite (two-part) error term. In particular, we estimate technical efficiencies of the sample farm households, given their difference in credit constraint status. Based on stochastic efficiency method, a general stochastic frontier model is defined as:

\[ y_i = f(x_i; \beta) \exp(v_i - u_i); \quad (i = 1, 2, \ldots, n) \]  (1)

where \( y_i \) represents the output of the \( i \)th farm household, \( n \) being the sample size, \( x_i \) a vector of variable inputs, \( \beta \) is a vector of technology parameters, \( f(x_i; \beta) \) is the production frontier. The symmetric random error \( v_i \) accounts for random variations in output, which is assumed to be independently and identically distributed as \( N(0, \sigma^2_v) \) independent of the \( u_i \)s; the \( u_i \)s are non-negative random variables, associated with technical inefficiency in production, which are assumed to be independently and identically distributed and truncations at zero of the normal distribution with mean, \( \mu \), and variance, \( \sigma^2_u \), (i.e., \( |N(\mu, \sigma^2_u)| \)). The variance parameters of the model are parameterized as \( \sigma^2 = \sigma^2_v + \sigma^2_u \), \( \lambda = \sigma^2_u / \sigma^2 \) and \( 0 \leq \lambda \leq 1 \). Given the distributional assumptions of \( v_i \) and \( u_i \), the estimate of \( u_i \) can be derived from its conditional expectation, given the composite error \( \epsilon_i = v_i - u_i \), applying the standard integrals (Jondrow et al., 1982).

\[ E(u_i | \epsilon_i) = \mu_i + \sigma_i* \left[ \frac{\phi(-\mu_i / \sigma_i*)}{1 - \Phi(-\mu_i / \sigma_i*)} \right] \]  (2)

where \( \mu_i^* = (\mu^2_v - \epsilon_i \sigma^2_v) / (\sigma^2_v + \sigma^2_u) \) and \( \sigma_i^2 = \sigma^2_v / (\sigma^2_v + \sigma^2_u) \) and \( \Phi(.) \) and \( \phi(.) \) represent cumulative distribution and probability density functions, respectively. Therefore (1) provides estimates for \( v_i \) and \( u_i \) after replacing \( \epsilon_i \), \( \sigma_v \) and \( \lambda \) by their estimates. That is, the output-oriented technical efficiency of the \( i \)th farm household \( TE_i \), given the levels of inputs, is defined as the ratio of observed

---

1 Empirical efficiency studies usually utilize either Data Envelopment Analysis (DEA) or SFA. DEA is a nonparametric approach employing linear programming to construct a piecewise-linear, best-practice frontier for each economic unit (Färe, R., Grosskopf, S. and Logan, J. (1985) The relative importance of publicly owned and privately owned electric utilities. Journal of Public Economics 26: 89-106.). Although, it does not impose a functional form on the data, it attributes all off-frontier deviations to inefficiency by assuming away the possibility of noisy data. SFA explicitly accounts for random shocks and is thus more appropriate in an environment such as our study area, where data can be noisy.
output to maximum feasible output in a state of nature depicted by \( \exp(-v_i) \) (Battese et al., 1996) as follows.

\[
TE_i = \frac{y_i}{f(x_i; \beta) \exp(v_i)} = \exp\{-(u_i | \epsilon_i)\}
\]

(3)

The distribution of \( u_i \) limits the estimated technical efficiency of a farm household \( i \) between 0 and 1. The inefficiency scores \( IE_i \) of credit-constrained and unconstrained farm households are defined as \( 1 - \exp\{-(u_i | \epsilon_i)\} \) and are used as dependent variables in the estimated inefficiency effects models.

### 4. Empirical model

#### 4.1 Econometric model specification

To assess farm household-specific technical efficiencies using parametric approach, the log-linear Cobb-Douglas stochastic production frontier\(^\dagger\) is specified as

\[
\ln Y_i = \beta_0 + \sum_{k=1}^{6} \beta_{ik} \ln x_{ik} + v_i - u_i
\]

(4)

where \( Y_i \) is the aggregated value of farm outputs of the \( i^{th} \) farm household in the sample, measured in Ethiopian Birr\(^\ddagger\) and \( x_{ik} \) are the input variables, i.e., land, human labour, fertilizer, seed, herbicides and pesticides; the \( \beta \)'s are parameters to be estimated; and \( v_i \) and \( u_i \) are as defined earlier in equation (1). To compare technical efficiencies of credit-constrained and unconstrained farm households, equation (4) is estimated using maximum likelihood estimator (MLE) separately for the two sub-samples, identified by a variable indicating their credit constraint status.

To investigate the effect of farm households' demographic, socioeconomic and institutional factors on technical efficiency, the inefficiency effects model in equation (5) is separately estimated for the two groups of farm households using least squares method.

\[
IE_i = \delta Z_i + \eta_i
\]

(5)

where \( IE_i \) is inefficiency scores defined earlier; \( Z_i \) is a vector of proposed household demographic, socioeconomic and institutional variables affecting efficiency; and \( \eta_i \) is a random error term, assumed to be normally and independently distributed with mean zero and variance, \( \sigma^2_{\eta} \).

\(\dagger\) The log-linear Cobb-Douglas specification was preferred to other alternatives such as the translog due to its convenience to interpret the estimates readily.

\(\ddagger\) The exchange rate was at 8.80 Birr =1USS in January 2007.
4.2 Model variables and hypotheses

4.2.1 Dependent variable

It was hypothesized that the CCFHs would be more efficient than CUFHs. To test this, data collected from farm households were classified as credit-constrained and credit-unconstrained as reported by the sample farm household heads. Farm outputs were measured as annual farm revenues, by also accounting for the values of unsold and home-consumed outputs. Assuming same average output price in a season at which the farm households could sell their outputs, the revenues allowed aggregation of multiple outputs (Parikh et al., 1995), which otherwise was difficult to aggregate. Farm revenue per hectare was used as dependent variable in the estimation of the stochastic frontier production function, as used by other researchers (e.g., Alene and Hassan, 2006; Wadud and White, 2000; Feder et al., 1990). Assuming that production technologies are homogeneous within the sample and output prices are the same in a season, the difference in per-hectare revenue is believed to capture technical efficiency differential among credit-constrained and unconstrained farm households. In the inefficiency effects models of equation (5), the dependent variable is the inefficiency score defined earlier.

4.2.2 Independent variables and hypotheses

The independent variables for both the stochastic frontier production function and the inefficiency effects models are explained and their effects hypothesized as follows.

Production inputs

Land, labour, seed, fertilizer, herbicide and pesticide are inputs in the stochastic frontier production function specified in equation (4). The inputs are expected to have positive effect on the value of outputs in the production function. However, suboptimal use of some inputs may result in negative output effect and inefficient production. Land \((\text{LAND})\) is the total land area operated by the household, including that owned, rented in, contracted in and obtained through gift, and measured in hectare \((\text{ha})\). Labour \((\text{LABOR})\) is family labour force and external labour supply (hired, exchanged, or gift), measured in man-days. Fertilizer \((\text{FERT})\) is the quantity of chemical fertilizers called UREA and DAP applied to the crop, measured in kilograms \((\text{Kg})\). Seed \((\text{SEED})\) is the measure of improved and local seed varieties used by farm households, measured in Kg. Pesticides \((\text{PEST})\) and herbicides \((\text{HERB})\) are measures of the quantities of pesticides and herbicides, respectively, used by the sample farm households, both measured in millilitres \((\text{ml})\). The quantities and qualities of the inputs and the technical skills of the farm households to use the inputs properly determine technical efficiency of the farm households.

Land is an important input to agricultural production affecting farm output (Wadud, 2003), but the effect of farm size on efficiency is mixed. Some studies suggest that small farms are more efficient than large ones, but others oppose to this, justifying based on economies of scale and scope associated with larger sizes.
However, undoubtedly, one can see that use of external inputs increases with farm size, and economies of size may be attained as farm size increases. Moreover, larger farms may positively affect lenders’ valuation of borrowers’ creditworthiness (Khandker and Faruqee, 2003), as do farm outputs and income. Farm households with large farms would allocate resources more efficiently because they would have better access to credit and would better finance farm operations and on-farm investments.

Agricultural production in developing countries is a highly labour-intensive economic activity. In addition to its direct effect, farm labour supply may also have indirect effect on efficiency since it is complementary to other farm inputs. However, all farm households are not equally endowed with family labour. A farm household with inadequate family labour may wish to satisfy its farm labour demand externally, and to pay for this, will demand credit. Therefore, if the farm household is constrained in the credit market, it may also be constrained in the labour market.

The other variable inputs are often not family supplied, except SEED where farmers may use from their saved harvests; they are rather purchased from the market. Credit constraint will have direct effect on their use (Demeket al., 1998) and their suboptimal use in turn will affect the use of land and labour inputs, and thus production efficiency. Farmers who are unconstrained in the credit market are more likely to choose optimal levels of these inputs than their credit-constrained counterparts are.

**Inefficiency factors**

After technical efficiencies are estimated for the two groups of farm households, sources of inefficiency differentials among farm households, besides credit constraint, are estimated using inefficiency scores as a dependent variable. As referred to earlier, the efficiency studies in Ethiopia and elsewhere (e.g., Coelli and Battese, 1996) show that several household demographic, socio-economic and institutional factors affect efficiency differentials among farmers. However, the effect of these factors varies in time and space, depending on specific situations in the study countries, making it imperative to test their effects also in this study area.

**Demographic factors**

Traditional farming has evolved over years through farmers’ own experience of continuous experimentation and learning. Farmers develop and accumulate experiences including farm financing over time, and learn about farm technologies and subsequent productivity effects, market behaviours, and general physical and economic environments to make choices. Farmers may enhance their productive efficiencies, as they get more experienced, learn how to increase income-generating capacities and become able to use cost-effective strategies to cope with adverse shocks. For example, experience in borrowing may help farmers to use external sources effectively to smooth output and income fluctuations. Controlling for this, the age of the farm household head (AGEH) is hypothesized to increase productive efficiency. Previous studies also indicate positive effect of experience on farmer
efficiency (Kalirajan and Shand, 1985; Stefanou and Saxena, 1988; Battese and Coelli, 1995; Battese et al., 1996).

Education is also expected to increase labour productivity by influencing managerial skills of farm operators, as skilled farmers are more likely to allocate resources more efficiently. Hence, education level (EDUCL) as measured in farm household head's years of schooling is included with a positive effect. Nevertheless, results from previous empirical studies are mixed. For example, while Bravo-Ureta & Pinheiro (1993), Ali & Flinn (1989), Parikh et al. (1995) and Battese et al. (1996) show that education has a positive effect on farmer's efficiency, others such as Kalirajan & Shand (1985) and Adesina and Djato (1996) found no significant effect.

Another factor possibly affecting technical efficiency of farm households is household size (HHSZ). Family labour is often an important source of labour supply in farm households in developing countries. In a situation where rural labour market is underdeveloped, which is also the case in the study area, coupled with credit constraint, farm households with inadequate family labour will experience farm labour deficit, others may experience idle labour surplus. Household size is expected to have a positive effect.

Socioeconomic factors
Here, household wealth and land fragmentation are included. Household wealth (WEALTH) captures the market value of total household physical properties such as farm implements, machineries and other stocks. Household wealth is expected to ease credit constraint in two ways. On the one hand, wealthier farmers are expected to own more assets, and will thus have more potential for equity financing, which in turn will generate more income. On the other hand, if equity finance falls short of total financial requirement, since wealthier farmers own more farm assets, this will increase their probability of obtaining external finance through its positive influence on lenders' valuation of creditworthiness. Thus, wealth is expected to have a positive effect on efficiency of particularly credit-constrained group, who often have smaller wealth.

Fragmentation of landholdings (LANDFRAG) is commonly regarded as a major obstacle to growth in agricultural production in developing countries (Tan et al., 2006). The more the number of plots per total operational holding of a farm household and the smaller the plot size, the higher the degree of land fragmentation and the less likely is the opportunity to apply new technologies (especially indivisible ones) such as irrigation facilities. Therefore, a negative effect is expected.

Institutional factors
Institutional factors are important determinants of productive efficiency (Fulginiti et al., 2004). One such factor is access to extension service (EXACSS). In this service, farm households often obtain information on improved crop varieties and breeds of animals. However, individual variations among farm households in accessing, searching and utilizing extension services are expected. As technology adoption depends on this service, those with access are expected to be more efficient. Based
on results from previous studies (Bravo-Ureta and Pinheiro, 1993; Bindlish and Evenson, 1993; Parikh et al., 1995) a positive effect is hypothesized.

Efficiency may also be affected by farm households’ access to credit information. A farm household cannot apply for loan without having information. Those with access to credit information (CREDINFO) will be in a better position to decide optimally on external financing and become more efficient than others, hence a positive effect is expected. A farm household may be quantity (loan size) rationed as the amount of credit obtained becomes inadequate for optimal choice of other variable factors of production, for desirable economies of scale require proportionate change in all factors of production. To see this, loan size (CREDSZ) is controlled for and a positive effect is hypothesized. Interest rate is a cost of capital to borrower farm households, and depending on choice of lenders, they may incur higher costs inefficiently. In this connection, for example, Gloy et al. (2005), studying the costs and returns of agricultural credit delivery in U.S., concluded that many large borrowers have access to credit rates that are more favourable. Therefore, we expect interest rate (INTEREST) to have negative effect on production efficiency. In Ethiopia, in general, and in the study areas, in particular, since communication and transportation infrastructure are less developed, access to available credit may be affected by physical proximity of the borrower to the location of the lender. To control for temporal and monetary costs of transportation, which are transaction costs to an individual borrower, distance to a credit facility (DISCREDF) is controlled for with expected negative effect.

5. Data

Ethiopia is one of the low-income developing countries where farmers and rural entrepreneurs operate under very poor infrastructure, with considerable adverse effect on their access to formal and semiformal lenders. Moreover, according to the existing land property rights law, farmers do not own land and this does not allow them to use land as collateral to obtain formal credit. This, among others, contributed to the rural credit market failure. The property rights problem, coupled with low level of the necessary infrastructure, entailed other forms of credit supply mechanism, such as third party guarantee scheme**, joint liability of co-borrowers often used by microfinance institutions and inventory-based credit supply**. However, it is yet too early to observe the effect of these mechanisms in meeting the credit constraints of farmers, as they only have been implemented for a few years.

The data used in this paper were obtained in a farm household survey conducted during September 2004 to January 2005 in Merti and Adamitullu-Jido-Kombolcha (AJK) districts of Oromia region, Ethiopia. These study areas are located at about

** Regional states offer third-party guarantee to commercial banks against possible defaults, enforcing repayment through local administrative machinery.

** This is a credit delivery mechanism in which farmers, who face temporary liquidity problem at times of low output prices, can borrow against a deposit of farm outputs at a common storage facility until higher output prices can be received for products.
200 km and 160 km, respectively, to the southeast of the capital, Addis Ababa (Finfinne). The farm households were selected randomly from six Farmers Associations (FAs) in the two districts – four from Merti and two from AJK. Using FA-level list of farm households as a sampling frame, 240 sample farm households were randomly selected. Survey enumerators administered the questionnaire to heads of sample households by visiting them at their farmsteads. As shown in Table I, large fractions of the sample farm households grow several crops such as maize (61%), onion (38%), barley (36%), wheat (31%), teff (30%), haricot beans (25%), sorghum (19%), and faba beans (15%) while relatively smaller proportions also grow other crops such as rapeseed, tomatoes and green beans. The farm households grow multiple crops to diversify their outputs in light of minimizing risks in yields and prices. This risk behaviour of farmers is partly a reflection of the extent of the credit constraints they face. By diversifying their products, they limit their choice of best product mix in order to minimize the occurrence of risk involved, sacrificing the benefit of using high-yielding technologies.

Table I: Proportion of farm households growing different crops

<table>
<thead>
<tr>
<th>Crop</th>
<th>Grower farmers (%)</th>
<th>Crop</th>
<th>Grower farmers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>61</td>
<td>Sorghum</td>
<td>19</td>
</tr>
<tr>
<td>Onion</td>
<td>38</td>
<td>Faba beans</td>
<td>15</td>
</tr>
<tr>
<td>Barley</td>
<td>36</td>
<td>Rapeseed</td>
<td>9</td>
</tr>
<tr>
<td>Wheat</td>
<td>31</td>
<td>Tomatoes</td>
<td>8</td>
</tr>
<tr>
<td>Teff</td>
<td>30</td>
<td>Peas</td>
<td>8</td>
</tr>
<tr>
<td>Haricot beans</td>
<td>25</td>
<td>Green beans</td>
<td>3</td>
</tr>
</tbody>
</table>

*Percentages are sample proportions of farmers growing a particular crop and do not add up to 100%, as most farmers diversify by producing multiple crops. Source: Own survey, 2004/05*

In addition to the usual demographic and socioeconomic variables, farm household heads were interviewed on whether or not they had information about lenders, whether or not they applied for credit from any external source in the last 12 months prior to the survey, whether or not their applications were accepted, and if so, the amount they obtained and whether or not they were constrained after receiving credit. Moreover, information on location of the lender, interest rates charged, type of credit obtained and repayments were collected.

Based on descriptive results shown in Table II, the characteristics of credit-constrained (CCFH) and credit-unconstrained farm households (CUFH) are discussed. The overwhelming majority of the sample farm households (70%) reported being credit-constrained, which is not surprising, given the low level of rural credit market development in Ethiopia in general, and particularly in the study areas. Although there is no statistically significant difference between CCFH and

\[ \text{Teff (Eragrostis tef)} \] is an annual cereal crop of grass family often used in production of injera, a major staple food in Ethiopia.
CUFH in terms of average age, household size and level of education, the two
groups have significant differences in other characteristics, as the mean difference
test statistics reported in the last column of Table II show. The CCFHs operate
more fragmented farmlands than the CUFHs, as measured in the number of plots.
The proportion of CCFH that applied for credit (65%) is significantly smaller than
that of the CUFH (71%). Since there is no significant difference in terms of access to
credit information between the two groups, this suggests that some CCFH did not
apply for credit for reasons other than lack of credit information. This can possibly
be due to farm households' fear of being rejected or consideration of transaction
costs in application decisions. However, the absence of significant difference between
the two groups' access to credit information does not imply that they both had adequate information. About 53% and 60%, respectively, of CCFH and CUFH had obtained loans and the difference is statistically significant (Table II). However, the statistical evidence of quantity rationing is not strong enough, as the difference in credit size between the two groups of farm households was statistically different from zero at only unconventional 11% level of significance. The fact that a considerable number of borrowers remained credit-constrained still makes the difference in credit size rationing between the two groups economically important to consider.

In terms of production inputs, there were significant differences between the two
groups of farm households. The CCFH operated more land and used more labour
but applied lower levels of seeds, fertilizers, pesticides and herbicides than the CUFH. Although land in Ethiopia is allocated to the farm households based on household size, the presence of informal land markets (Pender and Fafchamps, 2005) may cause difference in operational farm sizes among farm households with the same household size. In light of this, more land operated by the CCFHs are more likely due to larger household size, which is also the source of household labour supply. The variable inputs require more capital to purchase and it was observed that the CCFH applied them in lower levels than the CUFH. As a result, on the output side, the CCFH obtained less revenue per hectare of land than the CUFH. This pattern is similar to the finding by Feder et al. (1989), in which CCFH was observed to have used lower levels of inputs and obtained lower outputs than unconstrained farmers in China. Moreover, the CCFH had less wealth than the CUFH. This result also conforms with Banerjee’s (2001) theoretical claim, where it is argued that wealthier farm households get more access to credit because they can afford fixed transaction costs, bear more risk and are less risky to lenders than less wealthy farm households.

Nevertheless, since these summary statistics are unconditional means, much more can be learned by conditioning the average figures on relevant demographic, socioeconomic and institutional characteristics of the farm households, which is the focus of the econometric estimation in the next section.

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Independent t-test was used to test the null hypothesis of no difference between
the means of the two groups, where the reported t-ratios were derived as
\[ t = \frac{\bar{x}_u - \bar{x}_c}{SE(\bar{x}_u - \bar{x}_c)} \], and \( \bar{x}_u \) and \( \bar{x}_c \) are sample means of the variables for credit-unconstrained and constrained groups, respectively.
Table II: Sample descriptive statistics by credit constraint status

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Variable definition and measurement unit</th>
<th>Unconstrained</th>
<th>Constrained</th>
<th>Full sample</th>
<th>Mean difference test</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGEH</td>
<td>Age of household head (years)</td>
<td>42.23 (14.95)</td>
<td>43.69 (13.76)</td>
<td>43.25 (14.12)</td>
<td>-0.734</td>
</tr>
<tr>
<td>HHSZ</td>
<td>Household size (No. of members)</td>
<td>7.58 (3.01)</td>
<td>8.02 (3.97)</td>
<td>7.89 (3.70)</td>
<td>-0.863</td>
</tr>
<tr>
<td>EDUCL</td>
<td>Household head’s education (years)</td>
<td>4.04 (4.13)</td>
<td>3.13 (3.44)</td>
<td>3.41 (3.68)</td>
<td>-0.717</td>
</tr>
<tr>
<td>LANDWN</td>
<td>Total land owned (ha)</td>
<td>1.62 (1.17)</td>
<td>1.89 (1.34)</td>
<td>1.81 (1.29)</td>
<td>-9.615***</td>
</tr>
<tr>
<td>SEED</td>
<td>Crop seed used (kg)</td>
<td>141.10 (192.78)</td>
<td>137.63 (138.51)</td>
<td>138.68 (156.60)</td>
<td>-0.863</td>
</tr>
<tr>
<td>FERT</td>
<td>Chemical fertilizer used (kg)</td>
<td>165.58 (259.40)</td>
<td>129.42 (217.19)</td>
<td>140.42 (230.90)</td>
<td>10.077***</td>
</tr>
<tr>
<td>PEST</td>
<td>Pesticides used (100ml)</td>
<td>66.64 (69.05)</td>
<td>6.49 (18.03)</td>
<td>24.79 (49.31)</td>
<td>-3.750***</td>
</tr>
<tr>
<td>HERB</td>
<td>Herbicides used (100ml)</td>
<td>1.69 (3.86)</td>
<td>0.10 (0.23)</td>
<td>1.18 (3.31)</td>
<td>-3.750***</td>
</tr>
<tr>
<td>LABOR</td>
<td>Total labour worked (man-days)</td>
<td>127.45 (75.82)</td>
<td>132.62 (97.81)</td>
<td>131.05 (91.55)</td>
<td>2.449***</td>
</tr>
<tr>
<td>LANDSZ</td>
<td>Total land operated (ha)</td>
<td>1.73 (1.35)</td>
<td>1.83 (1.18)</td>
<td>1.80 (1.23)</td>
<td>-9.266***</td>
</tr>
<tr>
<td>OUTPVALL</td>
<td>Value of total farm output (100 Birr)</td>
<td>66.27 (82.03)</td>
<td>60.83 (83.62)</td>
<td>62.49 (83.01)</td>
<td>7.319***</td>
</tr>
<tr>
<td>WEALTH</td>
<td>Household wealth (1000 Birr)</td>
<td>26.23 (17.23)</td>
<td>9.56 (6.93)</td>
<td>14.63 (13.48)</td>
<td>6.705***</td>
</tr>
<tr>
<td>LANDFRA</td>
<td>Land fragmentation (No. of plots)</td>
<td>2.65 (1.58)</td>
<td>3.13 (1.70)</td>
<td>2.98 (1.67)</td>
<td>-2.003**</td>
</tr>
<tr>
<td>CREDsz</td>
<td>Size of credit obtained (Birr)</td>
<td>323.71 (596.22)</td>
<td>299.71 (573.88)</td>
<td>307.01 (579.62)</td>
<td>-1.529</td>
</tr>
<tr>
<td>CREDINFO</td>
<td>% of households with credit information</td>
<td>90</td>
<td>84</td>
<td>86</td>
<td>1.344</td>
</tr>
<tr>
<td>CREDAPPL</td>
<td>% of households applied for credit</td>
<td>71</td>
<td>65</td>
<td>67</td>
<td>-2.916***</td>
</tr>
<tr>
<td>CREDAPPR</td>
<td>% of households who obtained credit</td>
<td>60</td>
<td>53</td>
<td>55</td>
<td>-4.527***</td>
</tr>
<tr>
<td>EXACSS</td>
<td>% of households with extension visit</td>
<td>29</td>
<td>44</td>
<td>40</td>
<td>-8.432***</td>
</tr>
</tbody>
</table>

1Standard deviation of the means in brackets; sample means for dummy variables indicate fractions taking value 1 in the sub-sample. *** and ** indicate 1% and 5% significance levels, respectively, for test of mean difference between the two groups. Credit-constrained and unconstrained groups have sample sizes of 167 and 73, respectively.

Source: Own survey, 2004/05
6. Results and discussion

6.1 Estimated technical efficiencies

Maximum likelihood estimates of the parameters of the stochastic frontier production function specified in equation (4) are obtained using LIMDEP 7.0 software (Greene, 1995). The estimated values for the variance parameters, \( \lambda \), in the stochastic frontier production model are significant, which indicate that technical inefficiency affects outputs of the two groups of farm households. The estimates for \( CCFH \) and \( CUFH \) are presented in Table III. In the case of \( CUFH \), all input variables but \( HERB \) and \( LAND \) were statistically significant, and all but \( LAND \) and \( SEED \) showed the expected positive signs. \( LABOR \) had the highest input elasticity of production but \( HERB \) had the lowest, although the effect of \( HERB \) was not statistically significant. This implies that more farm revenue can be obtained by using more labour on the farm, as the production system in the study area is labour intensive. For \( CCFH \), all variables except \( HERB \) were statistically significant and all but \( LAND \) and \( SEED \) had the expected positive signs. Capital-intensive inputs such as \( FERT \), \( PEST \) and \( HERB \) had higher output elasticities for this group of farm households. The \( CCFH \) group used lower levels of capital-intensive inputs because of financial constraint, which is intuitive. Higher marginal effects of the limited capital inputs suggest that the \( CUFH \) could choose variable inputs more proportionally and this allowed them to have higher mean productive efficiency than the \( CCFH \).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Credit-constrained</th>
<th>Credit-unconstrained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>6.95 (12.51)*****</td>
<td>5.61 (11.78)*****</td>
</tr>
<tr>
<td>( \ln(\text{LAND}) )</td>
<td>-0.34 (-1.66)*</td>
<td>-0.11 (-0.86)</td>
</tr>
<tr>
<td>( \ln(\text{FERT}) )</td>
<td>0.13 (2.02)**</td>
<td>0.13 (4.47)*****</td>
</tr>
<tr>
<td>( \ln(\text{SEED}) )</td>
<td>-0.27 (-1.87)*</td>
<td>-0.19 (-2.77)**</td>
</tr>
<tr>
<td>( \ln(\text{HERB}) )</td>
<td>0.04 (0.72)</td>
<td>0.02 (0.70)</td>
</tr>
<tr>
<td>( \ln(\text{PEST}) )</td>
<td>0.07 (1.70)*</td>
<td>0.05 (2.24)**</td>
</tr>
<tr>
<td>( \ln(\text{LABOR}) )</td>
<td>0.58 (4.15)*****</td>
<td>0.69 (9.13)*****</td>
</tr>
<tr>
<td>( \lambda )</td>
<td>0.76 (12.82)*****</td>
<td>0.67 (11.16)*****</td>
</tr>
<tr>
<td>( \sigma )</td>
<td>1.48 (11.43)*****</td>
<td>0.90 (10.98)*****</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-351.15</td>
<td>-259.16</td>
</tr>
</tbody>
</table>

Values in brackets are t-ratios; ***, ** and * indicate 1%, 5% and 10% significance levels, respectively. The dependent variable is the natural logarithm (\( \ln \)) of the value of total farm output per hectare (in Birr). Sample size for credit-constrained and unconstrained groups is 167 and 73, respectively.

Policymakers are often interested in ranking firms in terms of their efficiencies to devise appropriate intervention policies (Dorfman and Koop, 2005). For this
reason, frequency distributions of the farm household-specific productive efficiencies for both the CCFH and the CUFH groups are reported in Table IV and more vividly displayed in Figure I. It can be observed that productive efficiency varies widely among sample farm households in both groups. The mean technical efficiency score was 67% for CUFH and 55% for the CCFH group, suggesting a significant deterrent effect of access to credit on the efficiency of the farm households. The two groups, which mainly differ in their credit constraint status, had a 12% difference in average technical efficiency. Compared to other studies, this 12% is higher than, for example, the 8.34% profit loss difference between expenditure-constrained and unconstrained farmers Blanchard et al., (2006) observed in France and the 8% Färe et al. (1990) observed in US. Since the proportion of CCFH in our sample is larger than the CUFH, improving credit access can significantly raise output. The average efficiency scores of 55% for CCFH and 67% for CUFH indicate not only the presence of significant efficiency gap between the two groups of farm households but also the presence of high level of technical inefficiency in both groups. The CUFH, on average, had potential loss of 33% in farm revenue due to technical inefficiency whereas the CCFH had about 45%, which suggests that both the gap in inefficiency between the two groups and the specific inefficiency of each group need to be reduced in order to produce at maximum possible technical efficiency levels.

Table IV: Frequency distribution of efficiency estimates

<table>
<thead>
<tr>
<th>Efficiency Score (%)</th>
<th>Credit-constrained</th>
<th>Credit-unconstrained</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of farm households</td>
<td>Percent</td>
</tr>
<tr>
<td>0&lt;28</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>28-33</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td>34-38</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>39-43</td>
<td>21</td>
<td>13</td>
</tr>
<tr>
<td>44-48</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>49-53</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>54-58</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>59-63</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>64-68</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>69-73</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>74-78</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>79&lt;100</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>55</td>
<td>20</td>
<td>75</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>67</td>
<td>28</td>
<td>85</td>
<td>11</td>
</tr>
</tbody>
</table>

*The mean, minimum, maximum and standard deviation of the efficiency scores are in percentages. Sample size for credit constrained and unconstrained are 167 and 73 respectively.

Not only the technical efficiencies were different between the two groups of farm households, but also there were differences in the distribution of the estimated technical efficiencies of the two groups of farm households. The minimum technical efficiency score for the CUFH was 28% but that of the CCFH was 20%. The
maximum technical efficiency score for CUFH was 85% whereas for the CCFH was 75%. Moreover, about 65% of the CCFH had 58% and less technical efficiency scores but only about 30% of the CUFH had such levels of technical efficiencies, indicating more loss in potential farm revenue of the CCFH than the CUFH. Figure I depicts the cumulative distribution of the efficiency scores for the two groups. The technical efficiency scores of the CUFH group were skewed towards the highest efficiency scores whereas those of CCFH were skewed towards the lower scores. That is, the majority of the CCFH had lower technical efficiencies, resulting in large aggregate loss in output. Since knowing efficiency scores is not an end by itself, additional factors contributing to the differences in the technical efficiencies of the farm households are discussed below.

Figure I: Cumulative frequency of farm households by technical efficiency score

6.2 Factors affecting inefficiency

The parameter estimates of the relationship between technical inefficiency and farm households' demographic, socioeconomic and institutional factors are shown in Table V. High $R^2$ values show presence of a strong explanatory power of the covariates and thus a strong goodness-of-fit of the model to the data. The F-test for joint hypothesis that all non-intercept coefficients in the model were zero was also rejected, indicating that the observed inefficiency differential between the CCFH and CUFH groups was not due to mere chance but explained by the included covariates. The fourth column of Table V shows estimates for the full sample, where a dummy variable, indicating whether a farm household had obtained a credit or not, was included for comparison. This is similar to the way most previous studies in Ethiopia and elsewhere used dummy variables. However, this dummy variable shows whether farm household took a loan or not but does not identify whether the farm households were still credit constrained after taking the credit or not. The estimated coefficient of this dummy variable turned out to be statistically insignificant, suggesting that credit had no effect on technical efficiency of the farm.
households. For example, the study by Haji & Andersson (2006) had concluded in this way. However, such conclusion may be incorrect since taking a loan may not necessarily mean that the borrower had his/her credit constraint resolved. Since this variable does not show the credit-constraint of a borrower, one needs to go further and identify whether or not the farm household is still credit constrained after taking the loan.

The estimates in the second and third columns of Table V explicitly considered the credit-constraint status of the farm households, and the following discussions are based on these columns. It should be noted that technical inefficiency scores were used in the estimated regression model, and therefore when we interpret the coefficients a negative effect of the estimate on technical inefficiency equally means a positive effect on efficiency.

Table V: Parameter estimates of inefficiency effects model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Credit-constrained</th>
<th>Credit-unconstrained</th>
<th>Full sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient (t-ratio)</td>
<td>Coefficient (t-ratio)</td>
<td>Coefficient (t-ratio)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.53 (1.82)**</td>
<td>0.73 (1.88)**</td>
<td>0.59 (3.55)***</td>
</tr>
<tr>
<td>AGEH</td>
<td>0.09 (2.25)**</td>
<td>0.05 (0.63)</td>
<td>0.06 (3.06)***</td>
</tr>
<tr>
<td>HHSZ</td>
<td>-0.05 (-0.61)</td>
<td>-0.07 (-2.33)**</td>
<td>-0.04 (-2.12)***</td>
</tr>
<tr>
<td>EDUC</td>
<td>-0.06 (-2.04)***</td>
<td>-0.03 (-2.04)***</td>
<td>-0.05 (-2.56)***</td>
</tr>
<tr>
<td>LANDFRAG</td>
<td>0.09 (3.11)****</td>
<td>0.07 (3.50)****</td>
<td>0.08 (3.17)***</td>
</tr>
<tr>
<td>EXACSS</td>
<td>-0.08 (-0.73)</td>
<td>-0.12 (-0.55)</td>
<td>-0.12 (-0.68)</td>
</tr>
<tr>
<td>CREDSZ</td>
<td>-0.10 (-2.11)***</td>
<td>-0.05 (-2.11)***</td>
<td>-0.07 (-2.32)***</td>
</tr>
<tr>
<td>WEALTH</td>
<td>-0.03 (-3.00)****</td>
<td>0.02 (0.44)</td>
<td>-0.03 (-2.71)***</td>
</tr>
<tr>
<td>CREDINFO</td>
<td>-0.07 (-0.44)</td>
<td>-0.04 (-0.27)</td>
<td>-0.05 (-0.93)</td>
</tr>
<tr>
<td>INTEREST</td>
<td>0.06 (1.20)</td>
<td>0.03 (0.90)</td>
<td>0.07 (0.67)</td>
</tr>
<tr>
<td>DISCREDF</td>
<td>0.07 (0.70)</td>
<td>0.05 (0.53)</td>
<td>0.05 (1.30)</td>
</tr>
<tr>
<td>CREDAPPR$^*$</td>
<td></td>
<td></td>
<td>-0.24 (-1.56)</td>
</tr>
<tr>
<td>No. of observation</td>
<td>167</td>
<td>73</td>
<td>240</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.89</td>
<td>0.86</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Notes: *** and ** indicate 1% and 5% significance levels, respectively. The dependent variable is inefficiency score ($IE_i$) as defined in the methodology part. $^*$This is a dummy variable taking value of 1 if the household obtained credit and 0 otherwise, included in the model using the full sample.
The age of the farm household head positively affected technical inefficiency of the CCFH, which is contrary to the hypothesis. For CUFH, age had not significant effect. A positive age effect for the CCFH means that older farmers were less efficient than younger ones. A possible explanation could be that the older farmers, although more experienced, might be more conservative and less receptive to modern technologies and farm practices that enhance technical efficiency than their younger peers. In Eastern Hararghe zone of Ethiopia, Seyoum et al. (1998) also observed a similar result in their study that compared technical efficiencies of farmers within and outside SG-2000 project, which was a pilot extension project later widely adopted in most agricultural regions of the country.

Household size significantly and negatively affected technical inefficiency of the CUFH group whereas it was insignificant for the CCFH group. This means that inefficiency decreases with household size of the CUFH. The CUFH could choose optimal levels of labour because they were not financially constrained. The insignificance of household size for the CCFH implies that labour supply did not matter for their efficiency, since because of credit constraint they could not proportionally choose optimal levels of other inputs. As expected, education level of the heads of farm households significantly and positively affected technical efficiency of both groups of farm households but with higher effect for the CCFH group. It means that technical efficiency of a farm household head increases with his/her formal schooling. Education, as a human capital, has multiple effects on the performance of the farm households, including acquisition, processing and utilization of information and farm managerial skills, which in turn can increase their technical efficiency. It suggests that public policy facilitating investment in farmers’ education can increase farmers’ technical efficiency. This result supports the effort Ethiopia has been putting on establishing farmers’ technical training centres at the level of Farmers’ Associations, the lowest rural administrative units.

Land fragmentation significantly and negatively affected technical efficiency of both groups of farm households, as expected. It means that fragmentation of a given fixed size of total farmland has inverse relationship with technical efficiency of the farm households. This may be explained in two ways. First, land fragmentation can deter optimal use indivisible technologies, such as irrigation equipment. Second, considerable amount of time and effort can be wasted in coordinating farm operations at different plots, especially as the distance between the plots increases. The result suggests that technical efficiency of the farmers can be improved by aligning farm plots allocated to a household. This has important relevance for land distribution policy in Ethiopia, where land is allocated to the farm households by the government. In a country where land markets function well, farmers may be advised to consider buying adjacent farm plots to reduce the negative effect of land fragmentation on their technical efficiency.

The amount of loan obtained significantly and positively affected technical efficiency of both groups of farm households, with the effect being more pronounced in the case of the CCFH group. The positive effect of the loan size can be seen in two ways. First, as the loan size increases, the unit cost of borrowing, including transaction costs, decreases because some of these costs are fixed regardless of the amount of loans and with increased loan size, the total cost thinly
spreads over large loan size and reduces average unit cost. Second, as the amount of loan increases, farm households may be less constrained to acquire improved technologies and choose optimal levels of inputs, making them less inefficient than others. The result suggests that for the loan to bring about significant impact on the technical efficiency of a farm household, the loan size should be adequate to meet effective demand. A larger loan size will also have a cost reduction implication for lenders in that unit cost of credit delivery will fall with increased loan size per borrower, which can also make the lender more profitable. This in turn can create an incentive for the lender to reduce the lending interest rate with increased loan volume.

The wealth variable significantly and positively affected technical efficiency of the CCFH group but insignificant for the CUFH. This means that technical efficiency increases with the wealth of the CCFH. Intuitively, as wealth increases, credit constraint tends to ease from both the demand and supply sides. That is, farmers' capacity to self-finance internally may increase as they get wealthier, reducing demand for credit. However, if wealthier farm households expand their farm operations and demand additional external resources, they will be more creditworthy and less rationed in the credit market than their less wealthy peers. For the CUFH, the insignificant effect of wealth implies that their technical efficiency was independent of their wealth. That is the CUFH can still attain desired efficiency levels since they are not credit-constrained to choose optimal levels of inputs. The significant effect of wealth on the technical efficiency of CCFH means that within the CCFH, relatively wealthier farm households are more efficient than less wealthy ones. This implies that technical efficiency of a credit constrained household depends on its wealth level.

The effects of the variables extension visit, credit information, interest rate and distance to a lender turned out to be statistically insignificant, which suggests that these variables did not matter for both groups' technical efficiency. Some possible reasons for their insignificance are the following. Extension visit and credit information might be insignificant probably because farmers had only a few visits to extension offices and had limited credit information that maybe did not add much to his/her existing information base. It may also be that farmers' technical efficiency may not improve by mere increase in farmers' extension visit and credit information. In this connection, for example Alene & Hassan (2006) argue that poor communication skills of extension agents and low extension-agent-to-farmer ratio would pose a limit to the number of beneficiary farmers in extension service. Similarly, lack of organized credit market information and farmers' lack of it can also contribute to the insignificant effect of the variable. This in turn implies that better qualities, rather than mere presence, of these services can have better effect. The variable distance to lenders was perhaps insignificant because there was no considerable variation among farmers to equally inaccessible lenders. It may also suggest that distance may not matter if other components of the transaction costs (such as paper works, speed of loan processing and disbursement) can be significantly reduced. Similarly, some barriers other than the interest rates might be more important to improve the credit constraint condition of the farm households and reduce its efficiency effect.
7. Conclusions and policy implications

In this paper we estimated technical efficiencies of credit-constrained (CCFH) and unconstrained farm households (CUFH) using parametric stochastic frontier technique. We found that the mean technical efficiency scores for CCFH and CUFH were estimated at 55% and 67%, respectively, which means that the two groups of farm households, on average, had technical efficiency difference of 12 percent. Although the credit constraint was the focus of this study, additional factors were also controlled for. It was found that the technical efficiencies of both groups of farm households were significantly affected by farmers’ education, land fragmentation and loan size. Besides, the efficiency of the CCFH was influenced by their farm experience and wealth, and that of the CUFH was affected by household size, as related to family labour supply. The results suggest that credit availability and loan size, farmers’ education and landholding structure need to be improved for all farmers. Moreover, especially for CCFH, farm experience (as related to farm management skills) and household wealth (e.g., through better facilities and incentives to increase saving and capital accumulation) require improvement. The study enriches the existing empirical literature dealing with credit constraints by explicitly treating credit constraint of the farm households, which often enter in earlier studies merely as a dummy variable. The direct elicitation method used allowed explicit comparison of farm households based on their credit constraint status. In general, the study demonstrated that farmers are not homogenous in their demand for credit and subsequently in their credit constraints, and this has important effect on their technical efficiency. The study also suggests that in efficiency analyses, more could be learned by explicitly considering credit constraint of farm households.

An important policy concern in developing countries in general and particularly in Ethiopia is raising agricultural production, given limited resources, to meet the ever-increasing demand for food due to increasing human population. However, attaining maximum possible output using a given level of inputs, in which relative variation among farm households in resource endowments and access to credit results in efficiency differential, requires careful studies. Agricultural credit policies generally aim at alleviating credit constraints of farmers in order for farmers to be able to increase their output production by producing at maximum possible technical efficiency. In light of this, the results of this study suggest that for a loan to result in higher technical efficiency, it needs to satisfy the effective credit demand of the farmers adequately. Given the largest proportion of the CCFH in the Ethiopian farming population, the 12% gap between technical efficiencies of CCFH and CUFH suggests that there are considerable potential losses in output due to inefficiency. This calls for a policy measure that would address credit constraint problem of both groups of farm households in general, and those of the credit-constrained group, in particular.

On the one hand, a “blanket supply” of credit to all farm households without considering their difference in effective credit demand and constraint status would not guarantee that such a credit supply would result in alleviation of farmers’ credit constraints. On the other hand, and more importantly, the credit-constrained group
would be less efficient than the unconstrained ones, resulting in low level of outputs. This, in turn, will adversely affect the capacity of farmers to repay the debt. At the aggregate, this will also affect the effectiveness of credit supply.

The fact that the CUFH are more technically efficient than the CCFH suggests that a credit supply that is responsive to effective credit demand of farm households would result in higher outputs, which would also increase creditworthiness of the farmers. An increase in farmers’ creditworthiness can raise lenders’ incentive to extend more loans to the extent that can meet effective credit demand of the farmers. In other words, adequate credit reduces credit constraint and increases technical efficiency, farm outputs and creditworthiness of borrowers. On the contrary, it would be economically unattractive for farmers to receive a loan that cannot meet their effective credit demand, as they will remain credit-constrained and cannot increase their efficiency. This suggests that lenders should identify farmers’ effective credit demand before determining loan sizes since farmers are not homogeneous in their demand for credit. In developing countries, government intervention in a credit system, as spurred by credit market failure, often becomes ineffective because it is delivered based on the implicit assumption that the farmers have similar demands for credit, thereby ending up in one-fits-all credit supply. This often does not match with effective credit demand of some farmers. This is evident from the fact that a considerable proportion of respondents who received credit also reported being credit-constrained. More often, significant credit defaults are reported in the formal credit sectors of developing countries. One possible cause could be that farmers cannot attain the necessary technical efficiency allowing debt repayment if the loans cannot meet their effective credit demand. However, ability to repay a credit, as related to higher output, could only be a necessary, not a sufficient, condition for debt repayment.

Another important implication of the results for credit policy is related to the cost of credit supply. The insignificant effect of interest rates on the efficiency of farmers suggests that factors other than the direct cost of borrowing may be important to consider. For example, some farmers may find monetary and non-monetary transaction costs (such as paper works, loan processing speed and speed of loan disbursement) higher than the interest rates. In this case, lenders need to consider the effect of such costs on the farmers’ demand for credit and devise strategy to reduce such costs, by using information technology, for example, which can lower costs of credit transaction, monitoring and evaluation. In the absence of IT facility, lenders need to consider the proximity of branches of financial institution to borrowers.
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References


Farm household demand for credit and its determinants in imperfect credit markets of Southeastern Ethiopia

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Abstract

This paper has estimated farm households’ demand for credit and identified its determinants in southeastern Ethiopia using censored regression. Results indicate that due to risk averse and rationing behavior of the formal credit sector and limited capacity of the non-formal credit sectors to meet farm households’ actual and potential demand for credit, there is excess credit demand in the credit market in southeastern Ethiopia. The formal credit sector limits its loans to only productive purpose, whereas the farm households had demand for credit for consumption purpose. Some farm households reported obtaining consumer credit from the non-formal credit sectors at considerably higher interest rates. Farm households’ demand for credit was positively affected by household expenditures on children’s education and medical care, among others. Because the farm household is the main source of farm labor, education and health of its working member affect farm labor supply and productivity. Since production and consumption decisions of farm households are interrelated, restricting credit supply only for either production or consumption purpose cannot address farm households’ effective credit demand. In light of the complementary relationship between production and consumption credits, it is therefore desirable that lending institutions should be able to diversify credit products and instruments beyond a narrowly defined single purpose.

JEL Classifications: D82, E51, O16, O17, Q14.

Keywords: Production credit, consumption credit; asymmetric information; credit sectors; smallholder farmers; Ethiopia.

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1. Introduction

The development of financial markets and institutions is crucial for a country’s economic growth (Levine, 1997). Credit, which is part of financial services, is one of the strategic factors that facilitate and stimulate the pace and pattern of socioeconomic development (Hicks, 1965; pp. 289-91). It does so by reducing costs of transactions and risk for intertemporal exchanges of goods and services, as money reduces transaction costs and risk for contemporary exchanges across space (Bhatt, 1988). It is thus an important strategic policy instrument to improve resource allocation, income and income distribution in an economic system (Ladman, 1974; Ladman and Tinnermeier, 1981).

Credit constraint, to the contrary, negatively affects constrain economic growth and development (Benhabib, 2000; Levine, 1997; Bencivenga and Smith, 1991; Saint-Paul, 1992). As the level of credit market development varies across countries, so are farm households’ demand for credit and lenders’ credit supply conditions. For example, agricultural credit development particularly in Sub-Saharan Africa is severely constrained due to inadequate financial development attributed to the presence of lender-borrower information asymmetries (Warning and Sadoulet, 1988). Unlike the market for real goods and services, credit markets are inherently imperfect since a credit transaction involves a relationship between a lender and a borrower in time inherently involving uncertainty (Bhatt, 1988). Problems of finance in the agricultural sector arise mainly from a seasonal nature of production and non-seasonal or steady pattern of consumption. In particular, agricultural inputs are required at specific periods different from the harvest time. Thus provisions for the consumption and production inputs in the current period require either saving from past harvest and/or borrowing against future harvest. However, because of marked contrast in seasonality of production and consumption patterns, credit demands may be in excess of household income at specific period.

Farm households’ demand for credit also arises from risk factors, such as crop failure and/or human and livestock disease and death, which adversely affect income. Agricultural development also requires intermediate and long-term financing for on-farm investments such as soil fertility improvement and investment in farm structure and production technologies, the rate of return of which may require several years to repay (Bekele and Drake, 2003). Nevertheless, rural credit system in most developing countries in general and particularly in Ethiopia focuses mainly on short-term loans.

Since early 1990s, several economic policies and strategies have been planned and implemented in Ethiopia. These include rural development strategy, food security strategy, industrial development strategy and poverty reduction strategy, among others (Diao and Pratt, 2007; IMF, 2006). Attempts were also made to liberalize the financial sector as part of the overall economic reform program. As a result, the banking sector, which was a government monopoly, has opened itself for
domestic private investment and following this, several private banks and insurance companies have entered the sector.

This policy change might improve supply conditions that address financial demand of the rural farm households. However, to my knowledge, there is no study showing farm households’ demand for credit and factors affecting it in Ethiopia in general and in the study area in particular. Therefore, this study aims at estimating farm households’ demand for credit and factors affecting it in two districts of southeastern Ethiopia. The rest of the paper is structured as follows. Short review of credit supply in the study areas and in Ethiopia at large is presented in section 2. A conceptual framework, empirical model and data used in estimation are described in section 3. In section 4, results and discussions are presented and the last section contains conclusions and policy implications.

2. Rural credit supply in Ethiopia and in the study areas

As in many other developing countries, farm households in Ethiopia interact with credit market segmented into formal, semiformal and informal credit sectors. Credit market segmentation is a situation in which agents face different prices and do not have access to the same technology (Montiel et al., 1993; p.45). Data could not be obtained on non-formal credit sectors’ supply responses, this sector is unorganized and outside of the regulatory institutions (Montiel et al., 1993; p.7). Therefore, in this section, the formal sector is described in great length whereas the non-formal credit sector is described only briefly.

2.1 Formal credit sector

The Ethiopian banking system consists of nine commercial banks (two public and seven private) and one development bank (Table 1). Most formal credit supply come from the public banks, which include the Commercial Bank of Ethiopia (CBE), Construction and Business Bank (CBB) and Development Bank of Ethiopia (DBE). The private banks entered the banking system about a decade ago. Although the share of the total private bank branches is increasing (hence increasing competition), more than 35% of the total bank branches are located just in the capital city, Addis Ababa (Table 1). Given total population of the country, which is currently estimated at 77 million (CSA, 2006), and the fact that not more than 5% are in the capital, more branches remain to be desired in the regional states. Even in the regions, not all districts have bank branches. For example, for six neighbouring districts including Merti, which is one of our study areas, there was only one commercial bank branch in Abomsa, the capital town of Merti district, whereas there were four in Zeway, the capital town of Adamitullu Jido Kombolcha district.

The reform has not allowed foreign financial institutions to enter the banking sector in Ethiopia, which means that the sector is subject to limited international competition.
### Table 1: Branch distribution of Ethiopian banking system as at Sept. 2006

<table>
<thead>
<tr>
<th>Banks</th>
<th>Branch distribution</th>
<th>Total</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Regions</td>
<td>Addis Ababa</td>
<td></td>
</tr>
<tr>
<td>Total public banks</td>
<td>187</td>
<td>49</td>
<td>236</td>
</tr>
<tr>
<td>Total private banks</td>
<td>89</td>
<td>102</td>
<td>191</td>
</tr>
<tr>
<td>All banks</td>
<td>276</td>
<td>151</td>
<td>427</td>
</tr>
<tr>
<td>Share (%)</td>
<td>64.6</td>
<td>35.4</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: NBE (1996)

Among the public banks, DBE and CBE are the two major lenders to the agricultural sector. For example, Croppenstedt et al. (2003) estimate that close to 80% of annual fertilizer purchases were covered by credit from these banks. The 1988 Rural Credit Policy of NBE, which made input loans the sole territory of Agricultural and Industrial Development Bank (AIDB) under the socialist regime, was revised under the current government. Because of massive loan default during early 1990s, AIDB sharply reduced its input loans to the farmers. Later absorbing the loss, the government granted AIDB a new start in 1992 and renamed it Development Bank of Ethiopia (DBE). While DBE has a long history of credit supply ever since its establishment as AIDB, CBE had entered into agricultural credit market just in 1994.

In 1996/97, a new credit system began with transfer of power of credit disbursement and collection responsibilities from the banks to the regional states, although some regions such as Oromia\(^2\) preferred these responsibilities to remain with the banks. In this arrangement, the regional states estimate input credit demand in the region and sign a loan agreement with the banks. The regional councils, in turn, advance loans to service cooperatives and farmers' groups. In this process, the Input Coordination Unit (ICU\(^3\)), established in 1995, facilitates loan disbursement and collection by the banks.

The ICU at the farmers' association (FA) level screens farmers who apply for credit and gives its recommendations to the service cooperatives. The service cooperatives collect similar recommendations from its member FAs and submit applications for credit to the district agriculture office (DAO). Where cooperatives do not exist, the FAs directly submit their request to the DAOs. The DAOs further screens and submit aggregated credit requests to the zonal ICUs, which review and decide on each proposal, based on the amount of credit made available to the

---

\(^2\) In Oromia, the regional state concludes the loan agreement with the banks on behalf of the borrowers but the banks themselves handle the processing and administration of the loan. The cooperatives or peasant associations apply to the banks for credit with a supporting letter from an authorized district official. The banks process the application and issue an input delivery order (Personal communication with Merti District Agriculture Office Head, December 5, 2004).

\(^3\) ICU comprises representatives from administration office, finance bureau, banks, suppliers and the ministry of agriculture at the regional, zonal, district and Farmers' Association (FA) levels.
district by the regional council. Once the request is approved, the district administration nominates input supplier and advises the district finance office (DFO). The DFO and the cooperatives sign a loan agreement and the cooperatives collect about one-fourth of the costs of inputs from the applicant farmers and deposit the sum at a lending bank. Following the signed agreements, the DFO issues a delivery order for the cooperatives to collect their shares from the selected supplier. In this process, the regional states provide guarantees to the banks on the timely repayment of the loans and, in case of a default, for its liability. This third-party guarantee arrangement has enabled the commercial banks to extend loans to rural borrowers by reducing administrative costs and default risks (in fact, transferring the risks from the banks to the regional states), which earlier were considered unbankable due to such costs and risk-averse behaviours of the banks. However, review process of the credit application was bureaucratic and made credit delivery more inefficient. For example, during the survey, the sample farmers reported delays in months before they could receive the inputs.

A total credit of about Birr 3.2 and 9.4 million were disbursed to the farm households in Adamitulu Jiddo Kombolcha and Merti districts, respectively, in the past five years prior to the survey period (OESPO, 2003). Given a total farm households in the two districts (27,632 in AJK and 25,146 in Merti) (CSA, 2006), the five-year average per capita credit sizes prior to the survey were about Birr 116.72 and Birr 373.62 and a yearly averages were Birr 23.34 and Birr 74.72 for the two districts, respectively. Practically, these loan sizes would not adequately cover total costs of agricultural inputs. Instead, it means that only a few farm households had received relatively larger loans, while most applicants were rationed out. This low per capita credit size suggests that formal credit supply to the farm households was limited, which is a reflection of disproportionate credit allocation at national level to the agricultural sector, in relation to the other sectors (NBE, 1996). It implies that farmers had used own resources, were able to borrow from non-formal credit sources or remained credit constrained.

![Figure 1: Input credit supply in Merti and AJK districts, 1997-2005](image-url)

Source: Commercial Bank Branches at Merti and AJK Districts

Figure 1: Input credit supply in Merti and AJK districts, 1997-2005
2.2 Semiformal credit sector

This category includes microfinance institutions, saving and credit cooperatives and farmers’ credit unions, which render financial services to members on priority basis and randomly to non-member farm households. It is subject to government regulation to some extent but less than the formal sector. At the time of the survey, there were 22 microfinance institutions (MFIs) in Ethiopia but later their number grew to 27 (NBE, 2007). About 30% of the MFIs were established by regional states and the others by non-governmental organizations. There are considerable variation in their geographic distribution and shares in total capital of the microfinance industry. For example, 11 of the 27 MFIs (or about 41%) were located in the capital Addis Ababa and 7 (or about 26%) in Oromia region, with 21.5% and 18.2% of shares in total capital of all MFIs, respectively. Moreover, about 64% of the total capital of all MFIs is owned by only four MFIs, i.e., Amhara (25.6%), Dedebit (24.3%), Addis (16.7%) and Oromia (14.7%) MFIs. Within a region, the existing branches of the MFIs have not covered some districts. For example, Merti District, one of our study areas in Oromia, had no branch of MFI. In September 2006, the total capital of all MFIs in Ethiopia amounted to 817.3 million Birr (or about 1.2% of GDP), of which 770.2 million (about 1.1% of GDP) was mobilized through savings and the rest from shareholders and donor funds, whereas it extended a total credit of about 2 billion Birr to about 1.5 million borrowers throughout the country (NBE, 1996). On average, the MFIs have extended a loan of Birr 1333 per borrower.

In the study areas, member farmers of three to seven FAs form a joint cooperative, which procures and sells agricultural inputs and industrial consumer goods to members on priority basis and randomly to non-members. In a district, several cooperatives form a joint cooperative union, which carries out similar activities at a larger scale. It also organizes sales of farm outputs at better prices on behalf of its member cooperatives. By organizing the marketing services at large scale, cooperative unions aim to reduce marketing costs and increase members’ sales revenues.

Since the objective of a cooperative organization is to satisfy its members’ demand for agricultural inputs and consumer goods, among others, prices relatively lower than the market prices are incentives for the farmers’ membership. Moreover, these cooperatives provide credit service only to their members and enforce its repayment in collaboration with the FA administration. However, reports indicate that these organizations often fail to deliver the desired services to the farm households due to lack of professional management and corruption. For example, almost all producers’ cooperatives established during the socialist regime (1974-1991) were dissolved when a new government took power in 1991 and introduced a market-oriented economic policy.

2.3 Informal credit sector

The informal credit sector has lived alongside the organized credit market, often unregulated by the government. Montiel et al. (1993:8) describe it as a market
response of economic agents to their economic environment. In Ethiopia, the informal credit sector includes rotating saving and credit associations (ROSCAs) (known as ikkub in Ethiopia), mutual-help clubs (e.g., iddir and mahber), friends and relatives, traders and moneylenders. This sector provides not only economic services to the farm households but also supports social events, such as weddings and funerals (Aredo, 1993; Begashaw, 1978).

Although one can find these informal financial organizations, particularly ikkub and iddir in almost every village, to study them requires more than a one-time survey, because they are not permanent institutions but often temporarily formed and dissolved, especially in the case of ikkub. It was only possible to ask the sample farm households’ participation in these institutions during a specific period. In the literature there are generally two types of ROSCAs—random and bidding (Besley et al., 1993). A random ROSCA allocates its pool of funds based on random drawing of lots, with the winning member receiving the pool for a specific period and this process repeated by excluding previous winners from the draw until each member receives the pool fund once. In the bidding ROSCA, members bid for the pool, which is allocated to the highest bidder. In the study areas, the common type of ROSCA is the random one. Given the nature of their organizational design, such quasi-institutions have little capacity to support the local economy as they are often subject to covariate risks affecting the local economy at large. They are locally organized, and for this reason cannot be used as risk-pooling schemes across different regions with different risk exposure. As these are only traditional institutions lacking modern entrepreneurial skills, they have little advantage to transform an economy to a higher growth stage. As environmental hazards adversely affect the natural resource base, these organizations cannot support the necessary dynamics to cope with the changes. For example, if all members of an informal organization are impoverished at the same time, there remains little to pool to spread risks among group members.

Looking at the supply side of rural credit in general, there are several conditions imposed by the different sources of credit that ration out farm households. Firstly, operating in a low-income economy, the financial sector in Ethiopia generally operates under shortage of loanable capital, and as a result, not all farm households who demand credit could obtain it. Secondly, the loanable funds are available only for specific purposes, i.e., for production or consumption, not both. Thirdly, in a situation where a financial intermediary makes loans to groups of farmers, farmers’ cooperatives or cooperative unions, which in turn lend the funds to the individual farm households, individual farm household is likely to be constrained. That is, the farm household may not be able to borrow the amount it would like to borrow since it is forced to conform to its cooperative union’s quota limits, which may not be consistent with its specific demands. Fourthly, the loan “quota” system in the formal sector that put the upper limit on the amount a farm household can borrow may not match farm households’ effective demand for credit. Lastly, since the formal credit sector requires a farm household to deposit one-fourth of the loan from its own savings as down payment, this is likely to exclude those who cannot afford such a down payment.
3. Theoretical framework

Credit is the trade of money, goods, or services in the current period for a repayment in the future period. However, unlike the market for real goods and services, credit markets are inherently imperfect since there is uncertainty about completion of a credit transaction until repayment is completed (Bhatt, 1988). Credit can be provided in the form of standard, formal loans or by a variety of informal means. In a standard loan, a lender provides a borrower with money in exchange for a borrower’s commitment to repay the principal and interest amounts later. However, this type of loan may not be the most common source of credit in developing countries. In these countries, lenders may be individuals or institutions whose main function is the provision of financial services, or they may also be traders, employers, landlords, or relatives of the borrower who lend money only in particular circumstances (Ghate, 1992).

A standard model of household demand for credit assumes that individuals aim to choose the amount of consumption in each time period to maximize their utility subject to an intertemporal budget constraint that the present value of consumption must equal that of income (assuming away bequest motive) (Hall, 1978). It also further assumes that (a) consumption and leisure are additively separable, which means that the utility function does not include the amount of leisure enjoyed; (b) the utility function is intertemporally separable, which means that the marginal rate of substitution of consumption in one period depends on the consumption in that period, i.e., no habit persistence or disappointment loss aversion (Garcia et al., 1997); (c) capital markets are perfect, which means that consumers can borrow all they wish, subject to their budget constraint at an interest rate equal to the lending rate; (d) individuals form their expectations rationally. Formally, this relationship can be represented as:

\[ \text{Max } \sum_{t=1}^{T} \left[ \frac{1}{1+\delta} \right] U(C_t) \]  
\[ \text{Subject to } \quad A_{t+1} = (1+r)A_t + Y_{t+1} - C_{t+1} \]  
\[ C_t \geq 0; \quad A_T \geq 0 \]

where \( Y_{t+1} \) is labor earnings at time \( t+1 \), \( A_t \) is nonlabor income at time \( t \), \( C_t \) is consumption at time \( t \), \( r \) is interest rate, \( \delta \) is rate of time preference, and \( T \) is the life length of the household.

The standard solution consists of the well-known Euler equation given by

\[ \left[ \frac{\partial U_t(C_t)}{\partial C_t} \right] \left[ \frac{1}{1+\delta} \left( \frac{E(\partial U_{t+1}(C_{t+1}))}{\partial C_{t+1}} \right) \right] = \frac{1}{1+r} \]
The left hand side of Eq.(3) is the marginal rate of substitution of \( C_{t+1} \) for \( C_t \) and the right hand side is the marginal rate of transformation of income in period \( t \) into income in period \( t+1 \).

If a household faces binding liquidity constraint, as in most of the farm households in developing countries, then increasing current labor income in a period would result in increased consumption in that period because larger income gives the household more resources to dispose of than their permanent income would allow. Formally, considering equations (1) and (2), allowing for nonseparability between consumption and leisure – so that utility is a function of both, and including a borrowing constraint, as in Weber (1993), the model becomes

\[
\text{Max } E, \sum_{t=1}^{T} \left[ \frac{1}{1+(1+\delta)} \right] U(C_t, I_t)
\]

Subject to:

\[
A_t = (1+r)A_{t-1} + Y_t + W_t(T-I_t) - C_{t-1} \quad \text{(budget constraint)} \tag{5}
\]

\[
A_t \geq L_t \quad \text{(borrowing constraint)} \tag{6}
\]

where \( Y_{t-1} \) is labor earnings at time \( t+1 \), \( A_t \) is nonlabor income at time \( t \), \( C_t \) is consumption at time \( t \), \( I_t \) is leisure at time \( t \), \( L_t \) is borrowing limit at time \( t \), \( r \) is interest rate, \( \delta \) is rate of time preference, \( W_t \) is labor wage rate at time \( t \), and \( T \) is life length of the household.

Forming the Lagrangian with a Lagrange multiplier for the budget constraint and Kuhn-Tucker multiplier \( \lambda_t \) for the borrowing constraint and maximizing with respect to \( C_t \) and \( I_t \), the following Euler equation can be obtained.

\[
\frac{\partial U(C_{t-1}, I_{t-1})}{\partial C_{t-1}} = \left[ \frac{\partial U(C_t, I_t)}{\partial C_t} - \lambda_t \left[ \frac{1+\delta}{1+r} \right] + \epsilon_{t+1} \right]
\]

where \( E(\epsilon_{t+1}) = 0 \).

An estimable equation can be derived from Eq. (7) by assuming a specific utility function and substituting it into its Euler equation version, which is not done here, for reasons apparent in the next paragraphs.

An important assumption in studying credit market in general is that the observed quantity of loans is the equilibrium value of either the intersection of demand and supply curves or the short side of the two curves. Suppose that the lending amount for a farm household \( i \), \( L_i \), is determined by the minimum of credit supply, \( S_i \), of lending institutions and credit demand, \( D_i \), of farm households, which is

\[
L_i = \min(D_i, S_i)
\]

9
In perfect credit markets, i.e., where there is no asymmetric information between lenders and borrowers, farm households with good profitability prospects in their farming enterprises can raise credit more easily than those with bad prospects. Under the law of one price (Persson, 2006), the interest rate should reflect all information the borrowers need to make rational decisions. However, in real life these assumptions are rarely satisfied and they are severely violated in imperfect credit markets of the developing world.

Institutional restrictions that can prevent lenders from offering differentiated financial products to heterogeneous borrowers, such as ceilings on interest rates or ‘discriminatory’ pricing, may lead to “disequilibrium” credit rationing (Frexias and Rochet, 1997: 138). As shown in Figure 2, with a backward bending credit supply curve, if the demand schedule is $D_1$, a competitive equilibrium exists, characterized by the equality of supply and demand so that the nominal rate $R_1$ clears the market. If the demand schedule is $D_2$, the supply and demand curves do not intersect and an equilibrium with credit rationing characterized by the interest rate $R^*$ and zero profit for the banks will occur.

**Figure 2: Equilibrium credit rationing**

Frexias and Rochet (1997: 139f) show that this will result in two types of credit rationing: *Type I* and *Type II*\(^5\). If the financed projects were divisible, the type of credit rationing that would prevail would depend on the technology of the borrowers: under decreasing returns to scale, it would be *type I*, and under

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\(^4\) The law states that in an efficient market all identical goods must have only one price.

\(^5\) *Type I* rationing occurs when there is a partial or complete rationing of all the borrowers within a given group whereas *Type II* rationing occurs within a group that is homogenous from the lender’s point of view, so that *ex post* some borrowers of the group obtain the loan they demand while others are rationed (Keeton, W. (1979) *Equilibrium Credit Rationing*, New York, Garland Press.)
increasing returns to scale it would be type II. Then supply and demand could intersect at an interest rate \( \hat{R} \), superior to \( R^* \). In that case, any bank could benefit from decreasing its interest rate if it was not bound to serve all credit applicants, and the market clearing level \( \hat{R} \) would be sustainable. If depositors know the relationship between the quoted interest rate and banks’ rate of return, a supply of deposits increasing in the rate of return will determine a supply of loans on behalf of the banks that is backward bending (Hogman, 1960). However, the presence of asymmetric information between lenders and borrowers would deter this from occurring.

### 3.2 Empirical framework

A farm household is considered to have effective demand for credit if its own capital falls short of the necessary financial requirement and as a result reveals his wishes to finance its economic activities by participating in credit market. Given that credit constraint is binding, the farm household may also have demand for credit: (i) even if it has not applied to a lender either because it lacks information on the availability of the credit source in the area or if it fears being denied because it lacks collateral, and (ii) if it cannot afford the transaction costs associated with the credit.

Sample farm household heads were asked: (i) whether or not the household had information on a particular source of credit; (ii) whether the households applied for credit from any source in the year prior to the survey; (iii) whether households’ applications were accepted and credit was obtained; and (iv) if credit was obtained, the amount they obtained.

A positive level of credit is observed only for households that had liquidity constraint, had demand for credit and were able to obtain it. For this group, borrowing constraint was not binding. A household faces a binding liquidity constraint if its desired stock of loan \( (D^*) \) exceeds the maximum amount lenders will lend to it \( (S^*) \) at current interest rates, i.e., \( D^* > S^* \). The desired stock of loan at any time \( t \) is the volume of credit in terms of consumption levels, which solves the utility maximization problem of the borrower in equation (4) at time \( t \). If we write the demand and supply models as:

\[
D^* = f_1(x_1, \varepsilon_1) \\
S^* = f_2(x_2, \varepsilon_2)
\]

where the level of credit observed is the minimum of the two, i.e., \( \min(D^*, S^*) \), a household is constrained if \( D^* > 0 \) and \( D^* > S^* \). Equation (9) can be rewritten as

\[
D_i = f_{1i} + \alpha_i (f_{2i} - f_{1i}) + \varepsilon_i
\]

where \( (f_{2i} - f_{1i}) \) indicates if a household is constrained, and \( D_i \) is the observed volume of credit. This is based on the assumption that \( \alpha_i \) is observed. When
observing only those who are constrained (i.e., \( \alpha_i = 1 \)) the supply function can be identified and when \( \alpha_i = 0 \) the demand function can be identified. Given that only the minimum of \( D^* \) and \( S^* \) is observed, the demand and supply functions are estimated by assuming \( \alpha_i = f(x_1, x_2, \varepsilon) \) where \( \varepsilon \) is an error term. Therefore, the model becomes:

\[
D_i = f_{1i} + P(\alpha_i = 1 | x_{1i}, x_{2i}, \eta)(f_{2i} - f_{1i}) + \varepsilon_i
\]  

(11)

where \( P(.) \) refers to the probability that a farm household is liquidity constrained, and \( \eta \) is the error term for the probability estimate.

Farm household demand for credit in general can depend on household income level and the total cost of obtaining credit. The main objective of farm household demand for credit is to meet consumption and/or investment (or production) needs. Some farm households who have demand for credit may not obtain it, as they would like to, due to internal and/or external credit rationing or unavailability of credit to the farm households with certain characteristics. As this rationing mechanism results in zero loan observation for those that do not succeed to obtain loans, estimation thus requires censored regression (tobit) technique. For the estimation, since theory does not offer a well-established model for credit demand, a specific functional form is not specified. Most empirical studies (e.g. Cox and Jappelli, 1993; Duca and Rosenthal, 1993) also did not assume a particular utility function but estimated a reduced form regression equation. Following this, we estimate the following reduced form equation:

\[
D_i^* = \beta_0 + \beta_{inc_i} + \beta_{inc_sqr_i} + \beta_{liq_i} + \beta_{rep_i} + \beta_{fsz_i} + \beta_{ini} + \beta_{inr_i} + \beta_{wli} + \beta_{yedc_i} + \beta_{10med_i} + \beta_{soci_i} + \beta_{12ird_i} + \beta_{13loc_i} + \sum_{j=1}^{19} \beta_{j} z_{ij} + \varepsilon_i
\]

(12)

\[
D_i = \begin{cases} 
D_i^* & \text{if } D_i^* > 0 \\
0 & \text{Otherwise}
\end{cases}
\]

(13)

where \( D_i^* \) is the latent and \( D_i \) the observed amount of credit of a farm household \( i \), \( \varepsilon_i \) is the random error term, assumed to be identically and independently distributed with mean zero and variance \( \sigma^2 \); \( \beta \) and \( \sigma \) are parameters to be estimated using maximum likelihood estimation procedure. The definitions and measurements of variables in Eq. (12) are given in Table 2.
Model variables and hypothesis

Household characteristics and socioeconomic variables are included in the estimated equation. The rationale for inclusion and expected signs of coefficients of the variables are discussed next.

Household characteristics

Age, education level, gender and religious belief of the head of a household and household size are controlled for in the estimated equation. Regarding the effect of age on household demand for credit, previous empirical studies (Okurut et al., 2005; Aizcorbe et al., 2003; Magri, 2002; Pitt and Khandker, 1998; Alessie et al., 2002) show mixed results. For example, Pitt and Khandker's (1998) found a 5% increase in expected credit demand for 10 year increase in the age of the women household head in Bangladesh but decreases for men household head at the same rate, whereas Aizcorbe et al. (2003) and Magri (2002) found a positive relationship. In Uganda, Okurut et al. (2005) found a positive effect of age on demand for credit.

Taking credit involves risk-bearing in decision making. Farm households in traditional societies are conservative in general but their risk-averse behaviour is expected to increase with age. Based on this prior, we hypothesize a negative effect of age on demand for credit.

Gropp et al. (1997) and Magri (2002) found a positive effect of the level of education of the head of household on the demand for credit in U.S. and Italy and they argue that human capital are more likely to increase job security and increase expected future income so that a greater willingness to smooth consumption. More educated farm household heads are more likely to adopt modern agricultural technologies than their less educated peers. Based on these priors, we hypothesize a positive effect of education level of the head of farm household on credit demand.

Farm household size is the source of farm and nonfarm labor. Consumption expenditure also increases with household size (Jappelli, 1990). In both cases, household size is expected to positively affect farm household demand for credit. There could also be differences in demand for credit between male- and female-headed farm households due to differences in labor supply behaviour and hence farm income or lenders may be gender-biased in their risk perception. For example, Magri (2002) found differences between male- and female-headed households' demand for credit in Italy, which was higher for female-headed and she argues that it may be because of lower income of female-headed households. In U.S. the 1976 Equal Credit Opportunities Act forbids the use of gender in credit scoring models (Crook, 2003). In Ethiopia, Equal Credit Opportunities Act is not legislated. Therefore, to see if there is any gender effect we include gender dummy, which equals one if male-headed, and zero otherwise and expect a positive sign. Ethiopian population comprises about equal proportions of followers of Islam and Christianity. In Islamic belief charging interest rates (or 'riba') are prohibited (Naser et al., 1999). Hence, to see if there are differences in demand for credit due to religious beliefs, we include a religion dummy, taking value one if the respondent is a Muslim and zero otherwise, and a negative sign is hypothesized.
Socioeconomic variables

Empirical evidences regarding the effect of household income on demand for credit are inconclusive. For example, Duca and Rosenthal (1993) find a positive effect which declines as income level increases whereas Magri (2002) finds a negative effect. In this study, a positive for income and a negative sign for income squared variables are hypothesized. The rationale is that the ability to repay debt (hence creditworthiness) is more likely to increase with the income level of a household since credit is a residual finance required to fill the gap between the desired level of total finance and household's own finance. The likelihood to obtain the external finance would increase with the household's internal capacity to match the demanded external loan. However, at sufficiently high level of income, demand for credit may decrease; hence, a quadratic relationship is expected through the squared income variable.

Wealth also plays important role in a household decision to borrow and its ability to obtain loans. Evidence shows that debt holding increases with the wealth levels of households (Duca and Rosenthal, 1993). This is often related to entrepreneurship and business start-up needs (Hurst and Lusardi, 2004). An increase in household wealth would reduce lender's risk and increase credit supply to the household. That is, the wealth of a borrower would serve as collateral for lenders, if the type of wealth owned by the household is acceptable to the lender. Wealth would also enhance the ability to repay debt through liquidation even in the case of a failure of a project financed through credit. Thus, wealth is hypothesized to have a positive effect on farm household demand for credit.

Liquidity constraint is an important push factor for a farm household to demand credit. A farm household is liquidity constrained if its desired level of credit exceeds the amount lenders are willing to supply (Jappelli, 1990). The inclusion of this variable in the demand equation can also serve to identify the presence of adverse selection in credit supply. That is, a positive sign on its estimated coefficient is an indication that those who obtain credit are those who face liquidity problem, and thus no adverse selection. A negative sign suggests the presence of adverse selection in credit supply.

Whether a farm household has repaid previous loan to apply for current loan may also be an important factor affecting demand for credit (Gropp et al., 1997). It is possible that heavily indebted farm household may be unable to service its debt, and so would rarely succeed to obtain another loan from the same source without repaying previous loan. However, depending on probability of being detected for defaulting, it may switch to another lender especially in the case of informal credit system (Aleem, 1993). In a situation where credit bureaus that facilitate information sharing among lenders on credit history of credit applicants are absent, as in Ethiopia, this becomes particularly relevant. Under this condition, a farm household may obtain another loan without repaying a previous one. This is controlled for by including a repayment dummy that takes value 1 if a farm household repaid past loans and zero otherwise.

Farm household demand can vary with operational farm size. For example, Kochar (1997) finds access to formal credit increasing with land size in India.
Similarly, the demand for credit may increase with the use of modern agricultural inputs, which include chemical fertilizers, improved seeds, herbicides and pesticides. The inclusion of these variables would thus capture if there is any difference between small and large holders, with expected positive effect of both on farm household’s demand for credit. Effect of access to irrigation on farmers’ demand for credit is also control for by including an irrigation dummy. Irrigation is a naturally critical component in reducing climate risk and improving crop production. Reducing climate risk can also help to induce the use of modern inputs, such as fertilizers and improved seeds, thereby further enhancing agricultural productivity (Diao and Pratt, 2007). Firstly, irrigation facilities require lumpy investments and a steady running cost, for which a farm household’s own savings may not be adequate to finance, especially at early stages of the investment. Secondly, access to irrigation reduces the risk of crop failure that otherwise would occur due to shortage of rainfall, thus reduce output and income variability, leading to more access to credit through its effect on creditworthiness of the farm households. For example, Kochar (1997) observed that access to irrigation increases the probability of access to formal credit. Thus, the net effect cannot be anticipated a priori.

In commodity markets, the demand for a commodity has inverse relationship with own price for a normal goods. In credit market, however, previous studies show mixed results. For example, while Stiglitz and Weiss (1981) argue that higher interest rate may not be to the advantage of the lender because it may increase the likelihood of default, Kochar (1997) argues that in formal credit market where credit rationing exists, a rise in the interest rate is more likely to reduce rationing and increase farm household access. Therefore, the effect of interest rate variable cannot be determined a priori. However, if the estimated coefficient of the interest rate turns out to be insignificant, this suggests less importance of the interest rate in determining demand for credit relative to other factors, which may be true especially where noninterest costs of transactions for the borrowers are relatively higher. In this connection, Yadav et al. (1992) argue that the high costs of external funds are due to high agency costs as well as high transportation costs, application fees, costs of lodging and accommodation and imputed time costs.

The above variables are related to credit demand of farm households for ‘production’ purposes. However, farm households may obtain credit for ‘consumption’ purposes such as expenditure on children’s education, medical treatment of household members and expenditure on social events. These purposes are not purely consumption, as they affect productivity of members of the farm households. For example, expenditure on children’s education may enhance the knowledge base of the household, which may enable them to adopt modern technologies. Since household members are the main source of farm labor supply, expenditure on development of this labor has also direct productivity effect. Similarly, in a society where informal loans are so important, a farm household’s participation in social activities (e.g. weddings and funeral associations) may be necessary for the household’s informal insurance. Therefore, household’s expenditure on children’s education, on medical care of household members and on social events would have positive effect on demand for credit. Finally, to see the
effect of location difference on demand for credit a district dummy is included in the model.

3.5 Data

Two sources of data were used for the study. First, published and unpublished secondary sources related to credit supply were reviewed. In addition, primary data were collected in a survey of farm households conducted during September 2004 to January 2005 in Merti and Adamitullu-Jido-Kombolcha (AJK) districts of Oromia Regional State, Ethiopia. These study areas are located at about 200 and 160 km, respectively, to the southeast of the capital, Addis Ababa (Finfinnee). Using list of farm households as a sampling frame, 240 sample farm households were randomly selected from six Farmers Associations (FAs) in the two districts – four from Merti and two from AJK. Survey enumerators administered the questionnaire to heads of sample households visiting them at farmsteads. The farm households were engaged in livestock-crop mixed farming systems.

Table 2 shows the sample descriptive statistics. The average age of the head of a farm household was about 43 years and ranged from 20 to 80 years. The level of education of the sample farm households was very low. On average, the head of the farm household attained less than four years of formal education, ranging from zero to eleven years. The average household size was about eight persons, which is considerably higher than the national average of six (CSA, 2006) and also ranged up to 24 members. The observed larger household size could be due to polygamous marriages common in the study areas and the presence of households of an extended family, where the household might comprise other members outside of the nuclear family (i.e., father, mother and children).

About half of the household members were dependants of school and/or preschool ages. On average, a farm household operated about 1.8 hectares of farm plots, owned about 4.6 TLU of livestock and assets worth of 14,634 Birr at market value, and earned a total annual income of 12,260 Birr. The average farm household was located at 17 km away from a formal financial institution, a distance fairly representing geographical centers of the districts considered (Komicha et al., 2007). Since road, transportation, and other infrastructural facilities are underdeveloped in the study areas, this distance might cause considerable constraint on farm household’s access to credit from the formal credit sector.

About half of the sample farm households had access to irrigation facilities, which use either water pumps operating on diesel engines and water pipes or gravity-based irrigation system. Since the national average of irrigation users is 4% (CSA, 2006), in the study area irrigation is relatively more developed than in other areas. In fact, those who had access to irrigation facilities are in the lowlands.

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6 TLU is a standard tropical livestock unit using conversion factors for livestock categories. The factors are 1.2 (camel), 1.0 (cattle), 0.1 (sheep), 0.1 (goat), 0.8 (horse), 0.7 (mule), and 0.5 (donkey) (Kassa, 2003).
7 Ethiopian currency with exchange value of USS 1 = 8.88 Birr (April, 2007)
Table 2: Descriptive statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Variable definition and measurement</th>
<th>Mean</th>
<th>Std.Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGEH</td>
<td>Age of household head in years</td>
<td>43.25</td>
<td>14.12</td>
</tr>
<tr>
<td>GENDR</td>
<td>Sex of household head</td>
<td>0.90</td>
<td>0.31</td>
</tr>
<tr>
<td>EDUCL</td>
<td>Education level of household head in number of years of schooling</td>
<td>3.41</td>
<td>3.68</td>
</tr>
<tr>
<td>HHSZ</td>
<td>Household size</td>
<td>7.89</td>
<td>3.70</td>
</tr>
<tr>
<td>RELGN</td>
<td>Religious dummy; =1 if Muslim</td>
<td>0.67</td>
<td>0.47</td>
</tr>
<tr>
<td>INC</td>
<td>household total income in Birr</td>
<td>12260.40</td>
<td>12368.00</td>
</tr>
<tr>
<td>WLT</td>
<td>Household wealth</td>
<td>14634.30</td>
<td>13483.40</td>
</tr>
<tr>
<td>FSZ</td>
<td>Operational farm size</td>
<td>1.80</td>
<td>1.23</td>
</tr>
<tr>
<td>IRD</td>
<td>Dummy for access to irrigation; =1 if with access</td>
<td>0.52</td>
<td>0.50</td>
</tr>
<tr>
<td>LIQ</td>
<td>Dummy for liquidity constraint; = 1 if constrained</td>
<td>0.70</td>
<td>0.46</td>
</tr>
<tr>
<td>REP</td>
<td>Dummy for repayment of previous loans; =1 if repaid</td>
<td>0.34</td>
<td>0.48</td>
</tr>
<tr>
<td>INR</td>
<td>Borrowing interest rate</td>
<td>30.70</td>
<td>43.03</td>
</tr>
<tr>
<td>INP</td>
<td>Aggregated cost of purchased agricultural inputs in Birr</td>
<td>729.40</td>
<td>1338.14</td>
</tr>
<tr>
<td>EDC</td>
<td>Household expense in children’s education in Birr</td>
<td>123.36</td>
<td>271.04</td>
</tr>
<tr>
<td>MED</td>
<td>Household medical expense in Birr</td>
<td>312.62</td>
<td>607.64</td>
</tr>
<tr>
<td>SOC</td>
<td>Household expense on social events in Birr</td>
<td>78.98</td>
<td>119.41</td>
</tr>
<tr>
<td>LOC</td>
<td>Location dummy for districts; = 1 if Merti</td>
<td>0.70</td>
<td></td>
</tr>
</tbody>
</table>

Source: Own survey, 2004/5.

which experience low annual rainfall, and had smaller farm sizes, but had higher average incomes compared to those practicing rain-fed agriculture in the midlands or highlands (Komicha et al., 2007). Those in the lowlands were relatively more market-oriented with cash crop production, with relatively higher market values than those in other areas.

A farm household spent about 123 Birr, on average, for children’s education, and this ranged from zero to 2750 Birr. The maximum amount reflects expenses on children attending high school or college education in locations other than their parents’ residences. The farm households had yearly average medical expense of about 312 Birr, which ranged up to 8000 Birr. The medical expenses were higher for those located in the lowlands, where disease prevalence, for example, malaria, is considered higher than in the highlands or the midlands. The farm households spent 729 Birr, on average, (ranging up to 9888 Birr) on purchases of agricultural inputs such as chemical fertilizers, improved seeds, pesticides and herbicides. A farm household spent an average of about 80 Birr on social events, and this also ranged up to 1000 Birr per annum in the sample.
Close to three-quarters of the sample farm households were liquidity-constrained but only about half of these were able to borrow from formal, semiformal or informal credit sources. Only less than one-third of the borrowing farm households were able to take loans from the formal sources. The average interest rate per annum for those who borrowed with interest rate was about 31%, and for the total sample, this ranged from zero to 150% per annum. It is common to find interest-free loans in the informal credit sector, especially from friends and relatives. Notably, the lowest and the highest rates of interest are in the informal sector, in which the interest-free credit was often linked to non-financial relationship between borrowers and lenders (Komicha et al., 2007). Official documents indicate that average lending rate in the Ethiopian banking sector (public and private) in the past five years has been 10.5% per annum with a minimum of 7% and a maximum of 14%, and the average saving deposit and time deposit rates had been 3.08% and 3.71%, respectively (NBE, 1996). It is also observed in the survey that only about one-third of the borrowers had repaid previous loans at the time of the survey. This could be related to the fact that repayment is low in the formal sector and there is repayment rescheduling in the non-formal sector.

4. Results and discussion

4.1 Farm households’ demand for credit

Maximum likelihood parameter estimates and marginal effects of the Tobit equation of farm households’ demand for credit are reported in tables 3 and 4, respectively. The average credit demanded evaluated at the mean values of the explanatory variables was Birr 196.48 per year, which amounts to about 1.6% of farm households’ average income. Given rural credit market conditions in the study areas explained in section 2, this credit size represents about an average cost of chemical fertilizers obtained in kind. Notably, this amount is far less than the total cost of agricultural inputs observed in the data, which was about 729 Birr, on average. This suggests that the remaining balance might have been financed from own savings of the farm households. Rural households’ demand for credit in the formal credit sector arises mainly to finance farm production, which requires modern agricultural inputs. Short-term rural credit supply in the formal sector targets loans for fertilizers, improved seeds, herbicides and pesticides. As discussed in section 2, a quantity quota in the formal credit sector that farmers receive can increase with the price of the inputs, which suggest that farm households would respond to change in input prices to maintain the use of the same level of inputs (Croppenstedt et al., 2003).

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8 For example, loans from friends and relatives, in which the borrower is expected to pay back only the principal, without being charged the interest. It could also be loans based on reciprocal compensation mechanisms, including labor supply, output sales or any other relationships agreed up on by contracting parties.
Seasonal agricultural loans usually come in the form of fixed input packages, sometimes irrespective of farm households’ effective demand that could vary due to variations in agro-ecological and socioeconomic factors. Therefore, the value of a loan for a package inputs may vary depending on farm households’ specific demand that could hinge upon agroecological and socioeconomic variations. For example, if a price for improved seeds rises and loans are not readily available, farm households may substitute local seeds retained from earlier harvests. However, it carries an opportunity cost of losing possible output due to low yield of such seeds. It means that if seed prices have no effect on credit demand, it implies that either the seed cost constitutes a small part of total input costs or as seed prices increase, farm households substitute the improved seed with seed retained from earlier harvest.

Despite the fact that credit is fungible, formal credit for agricultural inputs was supplied in kind for “production” purpose, while informal credit was used mainly for “consumption” purpose. About 70% of the sample farm households reported that they were liquidity-constrained (Table 1). Some of these farm households were credit-constrained despite the fact that they were able to borrow some amount of credit, which, in effect, means that they faced credit size rationing. In light of credit demand for both “productive” and “consumption” purposes, and the fact that there was considerable formal credit rationing on the supply side of the credit market, there exists unmet excess demand for credit. This also strengthens the presence of large gap between farm households’ credit demand and credit supply response of lenders, which concurs with earlier studies (e.g., Jabbar et al., 2002; Bali Swain, 2002; Freeman et al., 1998). It implies that the critical problem in the credit market is more from the supply side than it is from the demand side. This is further strengthened by the fact that large number of farm households face considerable credit constraints while formal lending institutions in Ethiopia hold more than legally warranted reserves (IMF, 2006). It also shows that the formal lenders are risk averse, which potentially arise from the presence of asymmetric information between lending institutions and borrower farm households. As Stiglitz and Weiss (1981) argue, asymmetric information among lenders and borrowers has consequences of screening of credit applicants (adverse selection), monitoring and supervision and default management (moral hazard). However, literature suggests that there need to be optimum level of response to the demand forces through innovative lending instruments on the supply side (Bhatt, 1988). As de Aghion and Morduch (2005) extensively argue, this may require adequate investment in the establishment of more convenient branches, at least at district levels, to reduce transaction costs to the borrowers and staff of the lending institutions.

### 4.2 Factors affecting farm households’ demand for credit

About half of the variables included in the model turned out to be statistically significant (Tables 3 and 4), which implies that farm households’ demographic and socioeconomic characteristics have important role in affecting their demand for credit. Accordingly, the age of a household head, household wealth, credit repayment, agricultural input costs, expenditure on children education and medical expenses significantly affected demand for credit.
Table 3: Tobit coefficient estimates for demand for credit

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1148.870</td>
<td>316.393</td>
<td>3.631***</td>
</tr>
<tr>
<td>AGEH</td>
<td>-8.877</td>
<td>3.370</td>
<td>-2.634***</td>
</tr>
<tr>
<td>GENDR</td>
<td>126.749</td>
<td>161.650</td>
<td>0.784</td>
</tr>
<tr>
<td>EDUCL</td>
<td>-12.094</td>
<td>12.109</td>
<td>-0.999</td>
</tr>
<tr>
<td>HHSZ</td>
<td>14.347</td>
<td>13.269</td>
<td>1.081</td>
</tr>
<tr>
<td>RELGN</td>
<td>-125.640</td>
<td>97.545</td>
<td>-1.288</td>
</tr>
<tr>
<td>INC</td>
<td>17.852</td>
<td>16.577</td>
<td>1.077</td>
</tr>
<tr>
<td>INC5Q</td>
<td>-0.0024</td>
<td>0.0032</td>
<td>-0.760</td>
</tr>
<tr>
<td>WLT</td>
<td>-13.131</td>
<td>7.409</td>
<td>-1.772*</td>
</tr>
<tr>
<td>FSZ</td>
<td>-14.637</td>
<td>39.776</td>
<td>-0.368</td>
</tr>
<tr>
<td>LIQ</td>
<td>6.921</td>
<td>159.301</td>
<td>0.043</td>
</tr>
<tr>
<td>REP</td>
<td>-737.629</td>
<td>69.975</td>
<td>-10.541***</td>
</tr>
<tr>
<td>INR</td>
<td>-2.275</td>
<td>1.107</td>
<td>-2.054**</td>
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</tr>
<tr>
<td>EDC</td>
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</tr>
<tr>
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<tr>
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<tr>
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<td>104.313</td>
<td>0.445</td>
</tr>
<tr>
<td>σ</td>
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<td>35.736</td>
<td>16.049***</td>
</tr>
</tbody>
</table>

Dependent variable

<table>
<thead>
<tr>
<th></th>
<th>Credit size</th>
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<tbody>
<tr>
<td>Conditional mean</td>
<td>196.48</td>
</tr>
<tr>
<td>Sample size</td>
<td>240</td>
</tr>
<tr>
<td>Loglikelihood</td>
<td>-1067.477</td>
</tr>
<tr>
<td>( \chi^2 ) (df = 18)</td>
<td>80.022</td>
</tr>
<tr>
<td>Pseudo-R²</td>
<td>0.3896</td>
</tr>
</tbody>
</table>

Note: Marks *** and * indicate statistical significance at 1%, 5% and 10%, respectively.
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</tr>
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<td>INC</td>
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<td>16.577</td>
<td>1.077</td>
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<tr>
<td>INCQ2</td>
<td>-0.0024</td>
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<td>-0.760</td>
</tr>
<tr>
<td>WLT</td>
<td>-13.131</td>
<td>7.409</td>
<td>-1.772*</td>
</tr>
<tr>
<td>FSZ</td>
<td>-14.637</td>
<td>39.776</td>
<td>-0.368</td>
</tr>
<tr>
<td>LIQ</td>
<td>6.921</td>
<td>159.301</td>
<td>0.043</td>
</tr>
<tr>
<td>REP</td>
<td>-737.629</td>
<td>69.975</td>
<td>-10.541***</td>
</tr>
<tr>
<td>INR</td>
<td>-2.275</td>
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<tr>
<td>σ</td>
<td>573.536</td>
<td>35.736</td>
<td>16.049***</td>
</tr>
</tbody>
</table>

Dependent variable: Credit size
Conditional mean: 196.48
Sample size: 240
Loglikelihood: -1067.477
\( \chi^2 (df = 18) \): 80.022
Pseudo-R\(^2\): 0.3896

**Note:** Marks ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.
Table 4: Tobit marginal effects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-ratio</th>
</tr>
</thead>
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<td>-2.6300***</td>
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<td>-0.9960</td>
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<tr>
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<td>1.0780</td>
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<td>-1.2930</td>
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<td>0.0000</td>
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<td>-2.0430**</td>
</tr>
<tr>
<td>INP</td>
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<td>0.0344</td>
<td>-2.4340***</td>
</tr>
<tr>
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<td>2.2730**</td>
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<tr>
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<td>55.3693</td>
<td>-0.0990</td>
</tr>
<tr>
<td>LOC</td>
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<td>47.1035</td>
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Note: The scale factor for marginal effects = 0.4498
Marks ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Demand for credit decreases with age of the head of a household. In magnitude, an increase by 10 years in the age of the head of the household is associated with a decrease by about 40 Birr in the expected demand for credit. Although not in magnitude, Pitt and Khandker’s (1998) similarly found that a 5% decrease in expected credit demand was associated with an increase by 10 years in the age of men household heads in Bangladesh. With increasing age of the farm household head, it is natural to expect that the household matures and may have accumulated assets, which can be liquidated in emergencies.

Although it was expected that credit supply to a farm household would increase with wealth level of the farm households by reducing default risk to lenders, it turned out to have a negative effect on farm households’ demand for credit. This indicates that as the wealth of a farm household increases, its demand for credit decreases. The estimated marginal effect shows (Table 5) that for one Birr increase in household wealth, demand for credit decreases by about 5.9 Birr. This also suggests that the farm households were not engaged in entrepreneurial activities,
which could have triggered their demand for credit at higher level of wealth. It suggests that those engaged in farm production would stay in farm even if they accumulate more wealth and do not integrate in non-farm economic activities. In another study, it was found that less than 15% of the sample farm households were engaged in non-farm activities (Komicha et al., 2007). This may partly be because credit supply to the farm households were only for farm production, and formal credit in rural areas had no such options to offer to borrowers to enable them enter into non-farm business.

There existed a strong negative relationship between farm households’ demand for credit and their previous credit repayment. Those who repaid previous loans had obtained less credit than those who did not repay. This counterintuitive result suggests the presence of adverse selection problem (Aleem, 1993; Hoff and Stiglitz, 1990; Stiglitz and Weiss, 1981) in the credit supply in the study areas. Absence of credit scoring mechanism, due to inadequate record keeping, might contribute to this inverse relationship. It could also be the consequence of corruption in the credit supply system, in which defaulters might be supplied credit in exchange for a solicited local support as Ladman and Tinnermeier (1981) observed in Bolivia. The fact that those who repaid credit obtained less credit than those who did not repay is an efficiency loss in credit supply, since it increases risk to the lenders and will have adverse effect on income distribution and economic growth in general.

As expected, the interest rate had negative effect on farm household demand for credit, which implies that farm household demand decreases as the lending rate of interest increases. However, it has a very small marginal effect in terms of magnitude. That is, ceteris paribus, for a percentage increase in the interest rate, farm household demand for credit decreases by about one Birr, which is quite little effect. It suggests that the interest rate is not as such a deterrent factor in credit supply, unlike other factors.

Farm households' expenditure on agricultural inputs had a negative effect on demand for credit. It indicates that those with larger expenditure on agricultural inputs demanded less credit than those with lower expenditure. Intuitively, those with larger expenditure would demand less credit if and only if they could finance the expenses from their own savings. It might also be possible that the observed expenditure on agricultural inputs might not be financed through in-kind credit, which is a constant quantity quota per farm household. In the quota system, a farm household might obtain certain volume of credit, irrespective of differences in farm sizes that varies with their effective demand for credit. The former case can be related to the wealth of the household, which was found to have inverse relationship with demand for credit. The likelihood of the later case can be supported by the fact that there was large discrepancy between average expenditure on agricultural inputs and the average credit size obtained (Table 2).

Expenditures on children’s education and medical expenses had significant positive effects on farm households’ demand for credit. In magnitude, for a one-Birr increase in the expenses on children’ education and medical care, the farm household demand for credit increases by about 0.19 Birr and 0.17 Birr, respectively. Sample farmers reported that this “consumption” credit could only be obtained from non-formal credit sectors, since formal sector credit supply to farm
households was limited only to in-kind agricultural inputs. In fact, there were reports in which farm households took in-kind loan and sold it to other farm household with more demand than that obtained through the quota system, to meet the “consumption” demand. This, in effect, was against the assumption of fungibility of money in credit supply that motivates in-kind credit, which was to prevent diversion of loans from their intended “production” use to “consumption” use since money is fungible.

The variables gender, education level, household size, religious belief, farm size, income, liquidity constraint, expenditure on social events, access to irrigation and location dummy turned out to be statistically insignificant. However, most of them showed the expected signs. The statistical insignificance of these variables shows little importance they play in credit demand. For example, the statistical insignificance of the liquidity constraint and farm size is an indication that farm households received input credit on quota, irrespective of their need due to liquidity problem and depending on their farm size, which supports the earlier explained fact that some borrowers sold the quota-obtained in-kind credit for “consumption” purpose. Furthermore, it suggests the need for diversifying credit products into cash and in-kind as long as the borrowers’ creditworthiness is maintained.

Although statistically insignificant, the estimated negative coefficient of the irrigation dummy suggests that those farm households with access to irrigation seem to have less demand for credit compared to those without access to irrigation. In another study (Komicha et al., 2007) it was found that farm households with access to irrigation had more savings than those without access to irrigation. In view of this, the inverse relationship between access to irrigation and demand for credit is more likely since more savings would lead to lower demand for credit, mainly because those with access to irrigation can produce more than once in a year, including during dry season, and could generate more income than those producing under rain-fed system.

The insignificance of the estimate of the district dummy suggests that there is no statistically different variation in farm households’ demand for credit between Merti and AJK districts, due to their locational difference. Although there are more number of financial institutions in the capital town of AJK than in Merti, demand for credit did not vary because of this. It further suggests that the presence of financial institutions in towns may not guarantee credit access of farm households who reside in rural areas, given underdeveloped transportation and communication infrastructure.

5. Conclusions and policy implications

This paper estimated farm households’ demand for credit and identified its determinant factors. Descriptive results indicate that there is excess demand for credit in the credit market of southeastern Ethiopia. This is mainly because the formal lending institutions deliver very little to the farm households. There is ample credit rationing in the formal credit sector and the non-formal credit sector has
limited capacity of to meet farm households’ actual and potential demand for credit. As a result, the majority of farm households faced credit constraints. Underdeveloped credit market in the country in general and in the study areas in particular is an important factor limited credit supply received by the farm households. Moreover, it was also observed that the formal credit sector limits credit service to only productive purpose but farm households borrowed for consumption purposes from non-formal credit market at considerably higher interest rates. However, since production and consumption decisions of farm households in a developing country context are highly correlated, the limitation of credit for a consumption purpose cannot fully address the diverse credit needs of the farm households.

Econometric results show that households’ expenditure on children’s education and medical care had significant positive effect on farm households’ demand for credit, whereas the age of the head of farm household, wealth, borrowing interest rate, debt repayment and expenditure on agricultural inputs has significant negative effect. Within the formal credit sector itself, credit is limited to agricultural inputs, despite that farm households’ demand for credit is more diverse than agricultural inputs. Demand for some consumption-related credit has effect on labor supply and productivity of the farm households. Credit supply response that does not consider farm households’ credit demand for production-related purposes such as education and health of household members, among others, thus fails to address farm households’ effective demand.

The main policy implication of the complementary nature of production and consumption activities of farm households is that lending institutions need to diversify their credit lines into both production and consumption purposes instead of limiting only to productive purpose. In particular, farm households should be able to borrow for children’s education as long as they are creditworthy to the lenders. The evidence that credit demand decreases with the wealth of the farm households suggests that expansion of credit supply to the farm households need to be supplemented by trainings in entrepreneurship skills to enable the farm households to diversify into non-farm economic activities. The result that debt repayment was inversely related to demand for credit suggests the need for credit scoring mechanism, which enables sharing of credit history of borrowers among lenders in the credit market to reduce adverse selection of bad borrowers.

In general, rural credit market in Ethiopia in general and in the study areas in particular needs to be developed in terms of developing and promoting innovative products and instruments that can adequately address diverse credit demand of the farm households. This would contribute to improvement in agricultural development and transform the rural economy, which is the backbone of the Ethiopian economy.
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References


This thesis examines saving, borrowing and production behaviours of farm households under imperfect financial market conditions. Results indicate that imperfect financial market conditions adversely affect economic performance of farm households, i.e., saving becomes suboptimal, credit supply falls short of effective credit demand, informal sector dominates the credit market, and credit-constrained farm households are less efficient than those unconstrained. The study suggests that policies geared towards developing the rural financial markets are necessary to improve performance of farm households.

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