Shocks and credit choice in Southern Ethiopia

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Abstract

Purpose – The purpose of this paper is to examine how shocks suffered by rural households in Ethiopia influence their decision to borrow and the source of credit.

Design/methodology/approach – First, suppose a household faces a set of four borrowing alternatives: only formal borrowing, only informal borrowing, both formal and informal borrowing, and non-borrowing. Second, the paper assumes that the random component is independently and identically distributed in accordance with the extreme value distribution. These assumptions lead to the multinomial logit model. The paper estimates the model using data from a survey of 350 rural households in Southern Ethiopia.

Findings – The paper finds that shocks are important factors in explaining both the decision to borrow and the source of credit. In particular, negative shocks that affect household's assets, such as the seizing of farmland and theft, or human capital, such as the death of the family head, reduce the probability of borrowing from formal lenders or from both formal and informal lenders at the same time. The study supports only to some extent the assumption that informal credit contributes to smooth consumption. Last, networking effect is very significant and demonstrates how the two markets interact.

Research limitations/implications – A model that would consider dynamic consumption patterns would have been more appropriate. In fact, one of the limitations of the study is the reliance on a cross-section analysis and the data is limited to just one village. Further research would extend the data set geographically and across time.

Practical implications – The formal lenders are not willing to provide contingent loans, maybe because of a limited ability to assess and diversify risk. Besides, the available formal credit products are not proper to finance long term risk management strategies but pesticides, fertilizers and improved seeds that are entirely used in every agricultural cycle. In this regard, proper risk transfer strategies and instruments, as well as better tailored loan products, are needed in order to increase outreach into the rural areas.

Originality/value – To the authors' knowledge, this is the first paper that investigates how shocks influence the decision to borrow and the source of credit in Ethiopia.

Keywords Microfinance, Borrowing decision, Formal and informal financial markets, Shocks

Paper type Research paper

Introduction

In rural areas of developing countries it is common for formal and informal credit markets to coexist side by side. Theoretical studies such as Hoff and Stiglitz (1990) point to factors that support the survival and prospering of the informal sector, such as advantages in information sharing within the informal market or credit constraints within the informal sector. However, if informal lending is only explained through those factors (such as in Bell *et al.*, 1997), the regular exchange, for instance, of

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small-sized, interest-free loans among rural dwellers of developing countries would be difficult to explain. According to Mauri (2000), and Adams and Fichett (1992), unlike the formal financial markets the informal financial markets in developing countries are multifaceted – blending elements of social, economic, and cultural ties.

Several empirical studies have attempted to identify the factors that explain the coexistence of formal and informal credit markets in developing countries. The emerging picture suggests that the relevant factors can change according to the environment considered.

Tsai (2004) proposes three explanations in a study of the credit markets in India and China. First, credit demanded by rural households appears to exceed the credit supplied by the formal financial sector, leaving some space for informal finance. This statement is confirmed by Swain (2002), who suggests that credit rationing in India is due to a combination of limited access to formal credit and a continuing high demand for such credit. Similarly, Park and Ren (2001) find that in China overall level of indebtedness is higher among microfinance clients suggesting that farmers are constrained at the margin, and formal supply of rural financial services does not suffice. Second, Tsai (2004) hints that formal intermediaries cannot fully identify the intended clients in Asia. As a consequence, commercial banks do not have sufficient institutional experience to downscale to the rural lender, and in addition, governmental banks focus on high lending volume and do not effectively provide financial services tailored to the demand of the poor. Besides, state actors may intentionally divert credit from the intended recipients, and non-state actors may distort and meddle with the provision of formal credit. As suggested and documented in Adams *et al.* (1984), subsidized loans typical of rural credit schemes in developing countries have usually ended up in the hands of local political and social elites. This further causes a segmentation of financial services along political and social lines. A similar effect is documented for insurance products. Finally, Tsai (2004) finds variations of preferences in loan uses, institutional design of lenders, and lending methodologies between borrowers of different economic strata.

Guirkinger (2008) notes that, in Peru, farmers apply to informal lenders because have limited access to the formal credit market. In spite of higher interest rates observed in the informal credit market the contracts are more balanced in the allocation of risk and show lower transaction costs than the formal sector. Borrowers thereby benefit from a lower net cost for the informal services. Guirkinger (2008) suggests further reasons for the lower net cost: informal lenders have informational advantages in screening, monitoring and enforcing; there exist economies of scope in the informal market that stems from the linkage of credit with other activities; and finally, informal intermediaries overcome various forms of non-pricing constraints and offer more flexible financial services.

Potential borrowers in the formal sector can be denied credit or offered smaller-sized loans for being too small and dispersed. For example, Besley *et al.* (2001) find that rural Nepalese households simultaneously resort to both the formal and informal financial sectors because of wealth effects. That is, rural households with greater incomes seem to accede more easily to the formal market. A specific transaction cost, identified as geographical distance, partially explains the lack of access to formal credit markets.

Aside from institutional deficiencies, market failures, and other economic factors, social and cultural factors must also be considered. Turvey and Kong (2010) compare the Chinese market of informal interest-free credit services with the microcredit services provided by formal intermediaries. They find that trust between borrowers

and lenders, and social preferences in borrowing are relevant factors that define the source and the destination of the loan. As trust increases, Turvey and Kong (2010) say the preference for the informal market increases and households thereby engage in more interest-free loans. A more likely granting of credit in the future eases the expected liquidity constraints.

Trust and social relations in the informal market are relevant. In the same way, some formal financial contracts are designed to tap local social capital for- screening, monitoring and enforcing of contracts, and to dramatically reduce the transaction costs to the borrower. For instance, with regards to group lending in Madagascar, Zeller (1994) finds that the ratio between a household's informal debt and wealth is a screening criteria of new potential borrowers in both formal group lending and informal lending. This suggests that community-based groups have an information advantage similar to informal lenders.

This study aims to contribute to the existing empirical literature on formal and informal financial markets with a specific focus on the credit preferences and risk management strategies of a sample of rural households in Southern Ethiopia. The study analyzes how shocks suffered by Ethiopian households can influence the decision to borrow and the source of credit. According to the existing literature, informal lenders usually have more flexible organization and contractual terms than formal lenders, and therefore are more able to provide credit for contingent consumption needs (Adams and Fichett, 1992; Udry, 1994). The absence of complete financial markets, however, contributes toward heightening risk. When risk cannot be transferred or reduced properly, households are forced to undertake several strategies to cope with environmental, economic, social and political hazards through production, employment and location decisions that are not optimal in terms of expected risk-return (Morduch, 1995). At the same time, risk remains an obstacle to the expansion of formal financial institutions into rural areas while transaction, monitoring and enforcement costs have been considerably reduced over the last 20 years by applying innovative approaches (Nagarajan and Meyer, 2005).

The study compares the formal credit market of the surveyed Ethiopian village (mainly consisting of microfinance institutions (MFI)) with the informal credit market. We find that shocks are important factors in explaining both the decision to borrow and the source of credit. In particular, negative shocks that affect household's assets, such as the seizing of farmland and theft, or loss of human capital as with the death of the family head, reduce the probability of borrowing from formal lenders or from both formal and informal lenders simultaneously. Moreover, a networking effect is very significant and demonstrates how the two markets interact.

This paper is organized as follows: the second section describes the Ethiopian rural financial system; the third section discusses the major risks faced by households in rural Ethiopia; the fourth section presents the sample, the rural credit market in the surveyed village, and a univariate analysis of shocks and credit choice; the penultimate section presents the multivariate approach and discusses the results; and the last section offers concluding comments.

The rural financial markets in Ethiopia

Ethiopia is among the poorest countries in the word, with a GDP (PPP) per capita of $1,110 (2011) and a life expectancy at birth of around 56 years[1]. Agriculture is the main economic sector and represents 45 percent of GDP and 85 percent of the labor force[2]. However, over the last ten years, real GDP in local currency has increased to

more than two times (by 135 percent) and real GDP per capita to more than one time and a half (by 66 percent) (NBE, 2012). The financial system has experienced a more marked growth. For instance, the number of bank branches has increased by more than three times since FY 2000/2001 (NBE, 2012), with every bank branch serving on average more than 82,000 people.

In 1994, after the end of the socialist regime, the Ethiopian financial system began to be privatized. However, the presence of the government in the financial sector has remained significant. The Ethiopian financial system comprises both formal, semi-formal and informal financial institutions. All segments of the financial sectors are vital and are expanding. The formal financial sector, supervised by the National Bank of Ethiopia (NBE), comprises the banking system, the insurance sector and the MFI sector (NBE, 2012).

Commercial banks and insurance companies are almost absent in rural areas, except for some government banks that, however, do not serve small farmers (Viganò and Bonomo, 2007; Dessié, 2000; Dejene, 1993). Financial intermediaries that are intended to play such a role are the MFIs[3].

The microfinance sector was formally regulated with Proclamation n. 40/1996, in response to previous unsuccessful rural credit schemes carried out by local governments and NGOs (Viganò and Bonomo, 2007). There were 31 active MFIs at the end of FY 2010/2011, with total amount of deposits of ETB 3.8 Bln (€155.54 Mln) and total amount of loans of ETB 7 Bln (€ 286.52 Mln)[4]. In spite of the number of MFIs, the three largest ones made up about 81 percent of total deposits and 74 percent of total loans (NBE, 2012).

Peck and W/Yohannes (2009) provides an analysis of the outreach and financial performance of 23 Ethiopian MFIs over the period 2005-2009. The number of active borrowers increased from 1.27 million to 2.2 million, and the outstanding loan portfolio and savings balance nearly doubled over the period considered (Peck and W/Yohannes (2009)). Despite the exceptional performance, none of the MFIs were financially self-sustainable in FY 2008/2009, with an average financial self-sufficiency ratio, after inflation and subsidy adjustments, of 52 percent (Peck and W/Yohannes (2009))[5].

The formal sector is flanked by other regulated financial institutions, including savings and credit cooperatives (SACCOs) that are not under the supervision of the NBE but instead are supervised by the Cooperative Bureau, which directly reports to the Federal Cooperative Agency. In mid 2006, out of the total number of SACCOs, 1,166 (21 percent) were rural savings and credit cooperatives (RUSACCOs) (Kassa *et al.*, 2007). The members of RUSACCOs grew from around 17,000 in 2004/2005 to more than 64,000 in mid 2006. RUSACCOs tend to concentrate on savings mobilization (Viganò, 2007), and their loan requirements are stricter compared to MFIs.

Apart from formal financial intermediaries, there exist informal financial actors and organizations that, except in a few cases, carry out financial transactions not tracked in the regulatory system. The informal intermediaries can be classified according to the level of organizational complexity. The most prevalent structured informal financial organizations are the *Iqqub* and the *Iddir*. Unstructured informal intermediaries are, for instance, networks of relatives, friends and neighbors, as well as moneylenders, suppliers and shopkeepers.

The *Iqqub* is classified as a ROSCA. In ROSCAs, savings are periodically collected in a common pool and then granted in turn to every member according to established rules[6]. In rural Ethiopia, *Iqqubs* allow poor farmers to save despite their low level of

income (Dejene, 1993). Apart from payouts, some *Iqqubs* offer also loans to members and the payment of an interest may be provided.

According to Dejene (2004), the main characteristic and advantage of *Iqqubs* is flexibility – which can concern the time when the *Iqqub* is formed, the amount of contribution, the frequency of payment, the loan destination and the number of possible memberships to other *Iqqubs*. Flexibility also includes finding innovative solutions to problems such as members' default, inflationary pressure, transaction costs and shocks (Dejene, 1993, 2004).

In the *Iqqubs*, common resources are allocated by a lottery system, by auction or by consensus. However, *Iqqubs* can also meet contingent needs of members and allocate funds based on urgency of each participant (Dejene, 2004).

Iqqubs are most common in urban areas (Dejene, 2004), but are also present in rural areas. Dejene (1993) finds that in rural Ethiopia around 17 percent of households in the highlands are members of *Iqqubs*, whereas Viganò *et al.* (2007) find a percentage of around 10 with a wide variation among the administrative zones (*woredas*) considered in the study.

Iddirs, on the contrary, are more common in rural areas than in urban areas. *Iddirs* are insurance parties where the number of members can be of several hundreds. There are two types of *Iddir* agreements (Bold and Dercon, 2009). One *Iddir* agreement type requires members to contribute on a contingent basis, that is when one member is affected by the insured event, while another *Iddir* agreement type requires members to contribute beforehand periodically, usually weekly, fortnightly or monthly, to a fund and affected members draw on the fund[7]. *Iddirs* can cover different kinds of idiosyncratic shocks, most notably the death of a family member or a relative. In this case, the amount received is proportional to the degree of kindred between the insured and the deceased. Many *Iddirs* also insure members against other kinds of shocks (illness, oxen death and so on) and grant contingent loans from the *Iddir* funds (Dejene, 2003).

Similar to *Iqqubs*, *Iddirs* also provide loans to members. Loans, usually interest-free and for very short-maturities, are granted to cover medical expenses or other contingent expenses borne by the member.

The major source of informal credit in rural areas of Ethiopia is, however, friends, relatives and neighbors (FRNs) (Dejene, 1993; Hoddinott *et al.*, 2009). Loans and gifts are provided on the basis of shared values, trust and expected reciprocity. The main differences from *Iddirs* and *Iqqubs* are the type of agreement and the level of enforceability of the agreement. While the insurance parties, *Iddirs*, and the ROSCAs, *Iqqubs*, are generally built on *ex-ante* payments and pre-existing multilateral agreements, networks of FRNs are based on bilateral relationships and transfers or loans within such networks are granted according to contingent incentives (Coate and Ravallion, 1993). Loans in networks of FRNs are usually of small size, interest-free and for uncertain or short maturities (Collins *et al.*, 2009). This is also the case in rural Ethiopia (Dejene, 1993; Hoddinott *et al.*, 2009).

Other sources of informal credit are moneylenders, suppliers and shopkeepers. Money lenders, in particular, known as *arata-abadari* in Amharic, has been active in Ethiopia for centuries and until the beginning of the twentieth century represented the only source of credit (Mauri, 1987).

Risks and shocks in rural Ethiopia

Harwood *et al.* (1999, p. IV) suggest that "[…] there are many sources of risk in agriculture, ranging from price and yield risk to the personal risks associated with

injury or poor health." Most farmers are mainly concerned about yield and price risk. Yield risk depends on soil quality, climate, the use of irrigation, and other variables. In contrast, price risk for a given crop depends on such factors as crop stock levels and export demand (Harwood *et al.*, 1999)[8]. All agricultural risks are interconnected though. Risks can also be classified into systemic risks (such as floods and drought) and idiosyncratic risks (such as death or illness of the breadwinner).

For rural Ethiopian households crop yield tightly depends on rainfall performance. Dercon (2004) discovers that, in Ethiopia, harsh rainfall shocks persist for many years and substantially hinder the consumption growth of poor households. For example, indicators used to determine the severity of famine in 1984/1985 are significant in explaining consumption growth in the 1990s.

Price fluctuations are also an important source of risk for Ethiopian farmers. Except for some cases, as discussed in Bonomo (2007) with reference to coffee farmers, they cannot diversify their price risk in international financial markets neither in wider local financial markets.

Many crop related risks are systemic but some farmers might be more affected than others. Other risks are mainly idiosyncratic such as the illness or the death of family members. In Ethiopia, one important idiosyncratic shock is the death of livestock. A pair of oxen is the main tractor for ploughing in rural Ethiopia and the illness or death of one or more oxen can markedly compromise the production capacity. Other livestock, such as donkeys and horses, are employed for transportation of goods from the village to the main local market. Livestock is therefore an important direct and indirect source of income. Dercon (2004) finds that livestock changes are positively correlated with food consumption. Livestock represents also an investment and most farmers prefer to save in animals, especially if safer and more remunerative alternative saving opportunities are absent. Livestock sale represents a significant coping strategy in times of hardship (Fafchamps *et al.*, 1998) but, especially in Ethiopia, farm households seem to divest themselves of other animals before disposing of oxen (Mongues, 2006). However, this latter strategy is poorly thought out, especially in periods of systemic shocks when the price of livestock dramatically decreases as a consequence of high supply and low demand.

In sum, Ethiopian farmers are exposed to several risks. Dercon and Krishnan (2000) suggests that in rural Ethiopia consumption strongly depends on rainfall performance, other shocks and time-contingent incentives, i.e., the opportunity cost of consuming in different periods. One of the main reasons why consumption strictly follows income shocks is due to the incompleteness of financial markets.

The inability to efficiently transfer risk leads farmers to avoid risky but profitable investment opportunities. In turn, when a negative event occurs, it further compromises the accumulation of human, social and physical capital. Furthermore, the ability of farmers to take on new opportunities in the future is compromised. Besides, if a nutrition-productivity link exists as some researchers suggest, then the inability to smooth consumption today will hinder productivity tomorrow.

The sections below present the empirical analysis and discuss the results.

Shocks and borrowing choice: univariate analysis

Aims and objectives of the survey

The goal of the survey is to analyze the factors that explain the borrowing decisions of farmers in the Ethiopian village considered. In particular, we want to emphasize the role played by negative shocks in such decisions.

This section conducts an univariate analysis of loan terms, shocks and the interaction of shocks with the borrowing decisions. The next section presents a multivariate analysis.

Survey and data collection methodology

The survey was conducted in one rural village (the smallest administrative unit; known as a *kebelé* locally), called Abala Faracho, of the administrative zone (*woreda*) Humbo. This village is located approximately 430 km from Addis Ababa. The village belongs to the Southern Nations, Nationalities and People's Region. It is in the low lands, and is about 3 km from the main road and 16 km from the main agricultural market in the township of Humbo. In the village there are nearly 4,450 residents. Subsistence agriculture constitutes 90 percent of the local economic activities[9]. There are no irrigation infrastructures in the village and the agricultural system, hence, is heavily rain fed. Most of the households live in traditional huts made of mud and straw, called *tucul*, and only few houses have metal roofing sheets[10].

In April 2010, over a period of two weeks, a sample of 350 households of the surveyed village was randomly selected and the respective household heads were interviewed by ten enumerators. The enumerators were undergraduate students at the local university and received a one-day training session. The interviewees were conducted employing a structured questionnaire that includes questions on the family structure, wealth, social participation, agricultural production, shocks, coping strategies and personal finance decisions. Besides, some other interviews were made to leaders of *Iqqubs* and *Iddirs*, the local government representatives and MFIs' village agents.

The survey is a case study of a single village and results are not generalizable to other villages in the region.

Loan terms and uses

In the surveyed rural village, a variety of formal and informal lenders coexist. We classify the borrowing choices of households in four categories: only formal borrowing (only-formal), only informal borrowing (only-informal), both formal and informal borrowing (both), and non-borrowing. As reported in Table I, almost 40 percent of interviewed households borrowed from only-informal sources whereas 11 percent borrowed from only-formal sources, and 12 percent from both formal and informal sources. Finally, more than 37 percent of households interviewed did not borrow in the period considered.

The village is served by two MFIs[11]. Loans from MFIs represent 77 percent of the total number of formal loans disbursed and 76 percent of the households that borrowed in the formal credit market. Other formal lenders are banks and rural savings and credit cooperatives, however, they represent only 5 percent of the households and 8 percent of the total number of formal loans[12].

The informal credit supply is, on the contrary, very diverse. However, a big role is played by FRNs. They provided 42 percent of the total number of informal loans and served 38 percent of households that resorted to the informal market. The other main informal lender is the *Iddir*. *Iddirs* indeed represent 30 percent of the total number of informal loans and 22 percent of the households. Moneylenders have a small share of the market. They lent to only 8 percent of the households that borrowed from the informal market and represent 11 percent of loans. The remaining 12 percent of households and 12 percent of informal loans disbursed are represented by traders, shopkeepers, farmer's cooperatives and *Iqqubs*.

	Number of households		Number of loans	
	Freq.	Freq. (%)	Freq.	Freq. (%)
A. Formal lenders				
MFI	60	75.9	63	76.8
Bank	2	2.5	5	6.1
RUSACCO	2	2.5	2	2.4
Lender not specified (missing)	12	15.2	12	14.6
Multiple lenders	3	3.8	–	–
Total	79	100.0	82	100.0
B. Informal lenders				
Friend, relative and neighbor	68	37.6	98	41.9
Iddir	39	21.5	70	29.9
Moneylender	15	8.3	25	10.7
Trader, shopkeeper or supplier	11	6.1	14	5.0
Farmers' cooperative	6	3.3	16	6.8
Iqqub	4	2.2	11	4.7
Multiple lenders	38	21.0	–	–
Total	181	100.0	234	100.0
C. Borrowing choice				
Only-formal	37	10.6		
Only-informal	139	39.8		
Both formal and informal	42	12.0		
Non-borrowing	131	37.5		
Total	349	100.0		

Table I.
Frequencies of households and loans, by lender

Source: Elaboration on data collected by the author

With regards to the different uses of formal and informal loans (Table II), while around 87 percent of the total number of informal loans were assigned to food, clothing, health care, education or ceremony expenses, the number of formal loans set aside for such expenses was merely 36 percent. On the contrary, 55 percent of formal loans were used for livestock, crop inputs or trading whereas only 13 percent of informal loans were destined to working or fixed capital[13].

These marked differences in terms of loan uses are also confirmed by the contrasting characteristics of loan terms (Table III). The size of formal loans (ETB 2,513) is on average about five times greater than the size of informal loans (ETB 542). Furthermore, maturity of formal loans (378 days) is on average three times longer than informal loans (124 days) and interest rates in the formal market (28.55 percent) are on average double those the informal market (13.77 percent). Last, the difference in the number of installments (3) reflects the difference in maturities. Variability of loan terms, as measured by standard deviation, is very high for informal loans in comparison to formal loans. Results suggest that informal lenders are more flexible and can provide a wider range of loans than formal lenders. On the other hand, formal lenders can provide better terms when the loan size becomes substantial.

Shocks in the surveyed village

The data collection on idiosyncratic and systemic negative shocks were partially collected following the methodology in Viganò *et al.* (2007). Some adaptations were made to allow for the peculiarities of the social and economic system in the surveyed village. Shocks are defined in the survey questionnaire as negative events that led to

	Formal				Informal			
	Freq.	%	Freq.[a]	%	Freq.	%	Freq.[a]	%
Food or clothing	15	19.0	33	30.3	96	53.9	137	58.8
Health care	0	0.0	1	0.9	4	2.2	22	9.4
Education	2	2.5	12	11.0	6	3.4	24	10.3
Ceremonies	0	0.0	2	1.8	12	6.7	21	9.0
House construction	0	0.0	1	0.9	0	0.0	0	0.0
Crop inputs	2	2.5	8	7.3	1	0.6	8	3.4
Livestock	21	26.6	38	34.9	3	1.7	10	4.3
Trading	12	15.2	14	12.8	5	2.8	6	2.6
Loan payment	0	0.0	0	0.0	4	2.2	5	2.1
Mixed uses	27	34.2	–	–	47	26.4	–	–
Total	79	100	109	100	178	100	233	100

Note: [a]In number of loans
Source: Elaboration on data collected by the author

Table II.
Uses of formal and informal loans

Source\term	Size (ETB)	Interest rate (%)	Maturity (days)	No. of installments
Informal	541.61 (759.24)	28.55 (103.95)	124.24 (160.53)	3.12 (5.29)
Formal	2,512.91 (1,207.20)	13.77 (10.14)	378.23 (192.78)	6.18 (5.59)
Difference	−1,971.3*	14.78**	−253.99*	−3.06*

Notes: Standard deviation within brackets. Tests assumes unequal variances. Assuming equal variances for "maturity" and "No. of installments" the statistical significance remains unchanged. *,**Statistical significance at 1 and 5 percent levels, respectively

Table III.
Contractual terms of formal and informal credit contracts

"loss of important assets or a dramatic reduction in family's consumption." Most shocks have a reference time of five years but family shocks, in particular the illness or death of a non-head member, and the illness of the family head, refer to a one year time span[14]. The death of the family head has no base time. The death of the family head is indeed a shock that can dramatically hinder the ability of farming for many years, especially in households where children are still dependants. In many cases, widows are forced to rent out the land through sharecropping agreements to other farmers, forgoing half or more of the total produce.

For the sake of simplicity and analysis shocks are classified in four categories: natural shocks, price shocks, family shocks and asset shocks.

In the village, the main source of risk is rainfall since the farming system is entirely rain fed. Both low and high levels of rainfall lead to possible crop failures. On the one hand, the interaction between drought and poor irrigation systems seriously compromises land productivity. On the other hand, in case of heavy rainfalls or too long periods of rain, the crops might be damaged or the planting period has to be postponed and this heightens the probability of failure. These shocks seem to be very covariant in the area considered (Table IV). The households that stated to have been badly affected by drought, heavy rainfalls or hailstorms over the past five years are 98, 73 and 33 percent, respectively. Land in the surveyed area is subject to erosion and heavy rainfalls can also cause mass movements. 25 percent of households stated to have been affected by landslides. These results are dissimilar from Viganò *et al.* (2007)

Table IV. Absolute and percent frequencies, by type of shock

	Period (years)	Overall		Only formal		Only informal		Both		Non-borrowing	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
A. Natural shocks											
Drought	5	343	98.3	35	94.6	139	100.0	42	100.0	127	96.9
Heavy rainfall	5	256	73.4	25	67.6	103	74.1	35	83.3	93	71.0
Landslide	5	87	24.9	11	29.7	36	25.9	12	28.6	28	21.4
Hailstorms	5	115	33.0	9	24.3	56	40.3	14	33.3	36	27.5
Plant pests and diseases	5	218	62.5	26	70.3	83	59.7	34	81.0	75	57.3
Vermin	5	117	33.5	11	29.7	47	33.8	13	31.0	46	35.1
Dangerous weeds	5	194	55.6	12	32.4	86	61.9	25	59.5	71	54.2
B. Price shocks											
Large increase in prices of											
Inputs	5	244	71.8	26	72.2	100	73.0	32	76.2	86	68.8
Large drop in prices of											
Cash trees	5	75	21.93	13	35.1	25	18.4	11	26.2	26	20.5
Cash crops	5	89	25.8	10	27.0	38	27.5	10	23.8	31	24.2
Other crops	5	40	11.49	6	16.2	12	8.6	6	14.3	16	12.3
C. Family shocks											
Death of family head	∞	52	14.9	0	0.0	26	18.7	2	4.8	24	18.3
Death of others	1	36	10.32	7	18.9	15	10.8	3	7.1	9	6.9
Illness of family head	1	34	9.7	5	13.5	11	7.9	5	11.9	15	11.5
Illness of others	1	80	22.92	7	18.9	39	28.1	9	21.4	25	19.1
D. Asset shocks											
Theft	5	31	8.9	2	5.4	16	11.5	2	4.8	11	8.5
Loss of farm land	5	60	5.4	6	16.2	27	19.4	3	7.1	24	18.3
Accidental fire or arson	5	21	6.1	1	2.7	9	6.6	1	2.4	10	7.7
Total		349	100.0	37	100.0	139	100.0	42	100.0	131	100.0

Notes: The shock variables are dummies and they take value 1 if the household stated to have been affected by that shock over the time span considered. The shock "death of family head" is considered as a long term shock and does not have a base time
Source: Elaboration on data collected by the author

that find percentages that are almost half of those found here. Differences in survey years, climate and especially in crop production considered can explain such disparity[15].

Extreme weather events, and the lack of access to improved seeds or pesticides, may also contribute to the spread of plant pests and diseases, vermin and dangerous weeds that, here, affected 63, 34 and 56 percent of surveyed households, respectively.

Regarding the existence of some price shock, roughly 70 percent of households stated to have been hit by large increments in seeds, fertilizers or pesticides prices. This percentage is nearly three-fold compared to farmers that declared to have been affected by large drops in cash-crop and cash-tree prices. The area surveyed has indeed an almost close economy, i.e., the produce is sold in the local market and prices are therefore set locally. The inputs are imported from other areas by local retailers and are subject to changes in national or international prices.

As for family shocks, 23 percent of households stated to have suffered from illness of a non-head family member, 10 percent from the illness of the household head, and 10 percent from the death of a non-head family member. In almost 15 percent of households the family head is dead. Finally, few households suffered from the loss of assets due to theft, 9 percent, seizing of farmland, 5 percent, or accidental fire or arson, 6 percent.

Univariate analysis

An univariate analysis of the frequencies (Table V) is carried out in order to draw some preliminary conclusions on the relationship between shocks and borrowing choice. With regards to natural shock variables, the most remarkable proportion-differences are for "plant pests and diseases" and for "hailstorms." Households that borrowed from both sources or only-formal sources were more affected by plant pests and diseases than non-borrowing households or households that borrowed from only informal sources. The proportion-differences are very statistically significant for the "both" case, equal to 20-25 percent. Households that borrowed only from informal sources were affected by hailstorms 16 percent more than "only-formal" households and 13 percent more than non-borrowing households[16]. With regards to the other natural shock variables, findings are less clear and cannot be interpreted straightforwardly. The proportion-differences for "heavy rainfalls" are statistically and economically significant for "both" households with respect to "only-formal" and "non-borrowing" categories; and proportion-differences for "dangerous weeds" are statistically significant for "both," "only-informal" and "non-borrowing" with respect to "only-formal."

For price shocks, "only-formal" households were affected 17 and 15 percent more on average by lower cash tree prices than the "only-informal" and the "non-borrowing," respectively. The other proportion-differences in price shock variables are not statistically significant apart from "other crops," where "only-formal" households were affected 8 percent more than the "informal."

These preliminary results for natural and price shocks point to difference in type of crop and farm size[17].

With regards to family shocks, "both" and "only-formal" households were between 14 and 19 percent more affected by the death of the family head than the "only-informal" and the "non-borrowing." Female-headed households seem to be more restricted to access of formal credit markets than male-headed households. Furthermore, "only-formal" households were between 8 and 12 percent more affected by the death of other family members than the "both," the "only-informal" and the

Table V. Test on equality of frequencies of shock variables

	Percent frequency differences					
	Both – formal	Both – informal	Both – non	Formal – informal	Formal – non	Informal – non
A. Natural shocks						
Drought	5.4***	0.0	3.1	−5.4*	−2.4	3.1**
Heavy rainfall	15.8***	9.2	12.3***	−6.5	−3.4	3.1
Landslide	−1.2	2.7	7.2	3.8	8.4	4.5
Hailstorms	9.0	−7.0	5.9	−16.0**	−3.2	12.8**
Plant pests and diseases	10.7	21.2*	23.7*	10.6	13.0***	2.5
Vermin	1.2	−2.9	−4.2	−4.1	−5.4	−1.3
Dangerous weeds	27.1*	−2.3	5.3	−29.4*	−21.8*	7.7
B. Price shocks						
Large increase in prices of						
Inputs	4.0	3.2	7.4	−0.8	3.4	4.2
Large drop in prices of						
Cash trees	−8.9	7.8	5.7	16.8**	14.7**	−2.1
Cash crops	−3.2	−3.7	−0.4	−0.5	2.8	3.3
Other crops	−1.9	5.7	2.0	7.6***	3.9	−3.7
C. Family shocks						
Death of family head	4.8***	−13.9**	−13.6**	−18.7*	−18.3*	0.4
Death of others	−11.8***	−3.6	0.3	8.1***	12.0**	3.9
Illness of family head	−1.6	4.0	0.5	5.6	2.1	−3.5
Illness of others	2.5	−6.6	2.3	−9.1	−0.2	9.0**
D. Asset shocks						
Theft	−0.6	−6.7	−3.7	−6.1	−3.1	3.0
Loss of farm land	−9.1	−12.3**	−11.2**	−3.2	−2.1	1.1
Accidental fire or arson	−0.3	−4.2	−5.3	−3.9	−5.0	−1.1

Notes: z-test on the equality of proportions. *,**,***Statistical significance at 1, 5 and 10 percent levels, respectively
Source: Elaboration on data collected by the author

"non-borrowing." Differences in frequencies for illness of other family members are not statistically significant.

For asset shocks, "both" households suffered less from loss of farmland than the "only-informal" and the "non-borrowing," 12 and 11 percent less, respectively. Even though land cannot be pledged as guarantee for loans, it can, however, be deemed as a proxy of the farmer's income generating capacity or propensity to invest on the field[18].

In order to analyze unobserved interrelations among shock variables, some shock indicators are built through multiple correspondence analysis[19]. Variables such as "drought," "large increase in prices of inputs" and "death of family head" are excluded. The drought variable has almost no variance; the input price variable is weakly correlated with the produce price variables; and the death of family head variable is an outstanding variable with very high statistical significance and a different base time.

As indicated in Table VI, the first component (1) of the indicator for natural shocks, and the indicators for produce price and asset shocks are positively correlated with all shock variables in the category and their interpretation is straightforward; whereas the second component (2) of the indicator for natural shocks and the indicator for family shocks are to be interpreted cautiously and according to correlations with each shock variable.

The test on equality of means (Table VII) shows that for the first component of the indicator for natural shocks, the most important in terms of inertia (72 percent)[20], the mean value of "both" is almost three-fold greater than all the other three alternatives. This difference is, however, more marked and statistically significant for "non-borrowing." The test on the second component of the indicator for natural shocks presents less clear results, the mean value for "non-borrowing" is almost three-fold greater than "only-formal" whereas the other differences are not statistically significant. As for the indicator for asset shocks, the mean value for "non-borrowing" is roughly eight-fold greater than for "both"; and "only-informal" is about three-fold and five-fold greater than "only-formal" and "both," respectively. As regards the indicator for shocks to produce prices, even though the size of the difference between

Type of shocks	Natural		Produce price	Family	Asset
Indicator component	(1)	(2)	(1)	(1)	(1)
Heavy rainfall	0.65	−0.09			
Landslide	0.58	−0.56			
Hailstorms	0.40	−0.44			
Plant pests and diseases	0.62	0.15			
Vermin	0.38	0.63			
Dangerous weeds	0.46	0.50			
Cash trees			0.79		
Crop trees			0.80		
Other crops			0.76		
Death of others				−0.56	
Illness of family head				0.56	
Illness of others				−0.76	
Theft					0.74
Loss of farm land					0.47
Accidental fire or arson					0.68
Principal inertia (%)	71.6	6.0	99.8	80.8	88.0

Note: All correlations are statistically significant at 1 percent level
Source: Elaboration on data collected by the author

Table VI.
Correlations between shock indicators and shock variables

Shock indicator	Relative mean differences					
	Both – formal	Both – informal	Both – non	Formal – informal	Formal – non	Informal – non
Natural (1)	2.89**	3.03***	3.30*	−3.13	−0.22	1.57***
Natural (2)	0.96	0.62	−1.10	−8.59	−3.46***	−1.26
Produce price	−0.69	2.57	8.99	6.04***	26.64	−4.09
Family	3.41	1.67	−0.27	0.72	−1.30	−2.08**
Asset	−1.15	−4.56*	−7.69*	−2.66***	−4.12	0.88

Notes: *t*-test on the equality of means assuming unequal variances. The relative mean difference is computed as $x_{i-j} = (x_i - x_j)/|x_j|$. *,**,***Statistical significance at 1, 5 and 10 percent levels, respectively
Source: Elaboration on data collected by the author

Table VII.
Test on equality of means of shock indicators

"only-formal" and "non-borrowing" is remarkable only the difference between "only-formal" and "only-informal" is significant; and for the indicator for family shocks, no difference is significant apart from "only-informal" and "non-borrowing," where the mean value for "non-borrowing" is almost two-fold greater than for "only-informal." These results hint at a rational farmer's behavior. When farmers have a sizeable land holding, they tend to borrow from the formal lenders in order to finance the agricultural activities but, as a consequence, they are more exposed to natural and price shocks. When such shocks occur, especially natural shocks, farmers borrow extra money from the informal market to make up for the reduced income. The perceived exposure to such shocks can also induce farmers to borrow for investment in preventing strategies.

By looking at the distributions of the shock indicators (Figure 1), some further conclusions can be drawn[21]. The distribution for "both" of the first component of the natural shock indicator is symmetric around a middle-high value, supporting the proportion-differences test, while for the other categories distributions are almost flat. It is worth noting, however, that the distributions for "only-formal" and "only-informal" present opposite skewness. The distribution of "both" seems to lie in-between.

With regard to the second component of the indicator for natural shocks, positively correlated with "vermin" and "dangerous weeds" variables, the distributions for "only-informal" and "non-borrowing" are concentrated around the middle value but the distribution for "non-borrowing" is slightly left skewed, that is higher values. Similarly, the distributions for "both" and "only-formal" are almost flat but the distribution for "only-formal" presents a slight left skewness.

The distributions of the indicators for produce price shocks and family shocks explain part of the ambiguous results in the proportion-differences test. In the former case, for very low values of the indicator, lower shock exposure, the distributions for "only-informal" and "non-borrowing" are strictly dominant with respect to "only-formal" and "both," but all have similar patterns for greater values. For the family shock indicator, all distributions have similar patterns with two peaks at roughly 3.5 and 7, respectively. At the latter peak, "only-informal" and "non-borrowing" are dominant, suggesting that the households in these categories were more affected by the illness of family head but less by the illness or death of other family members. At the other peak, the patterns are almost reverted.

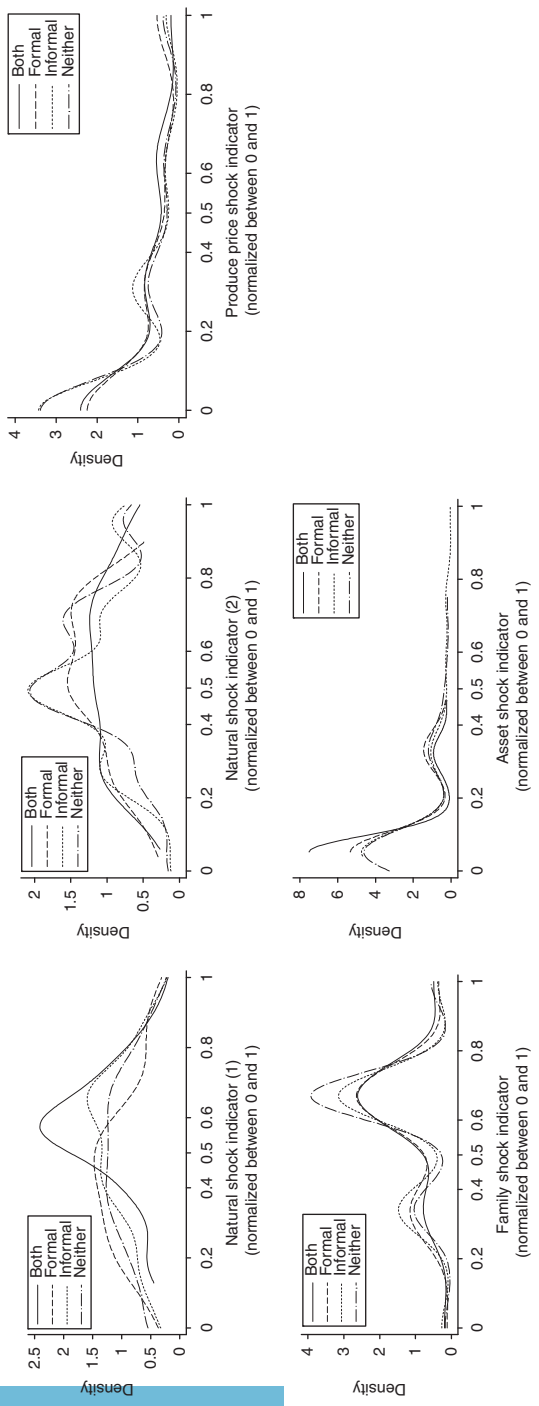

Figure 1.
Distributions of shock indicators

Finally, for the asset shocks indicator, a proxy for loss or seizing of assets, the distribution for "both" is very dominant for very low values of the indicator supporting the findings in the proportion-differences test.

In the next section, we carry out a multivariate analysis to better understand the effects of shocks on the decision to borrow and the source of credit.

Multivariate analysis: estimation approach and results

The econometric approach

In this section we want to analyze the combined effects of shocks discussed in fourth section on the borrowing choices of surveyed households. However, in comparison with stated choice methods (Louviere *et al.*, 2000), we can only observe revealed preferences, that is only household-specific variables can be employed for a multivariate analysis. Alternative-specific variables that refer to each borrowing choice are observed only for the choice selected by the farmer and not for the other alternatives as well. However, the analysis of loan terms and characteristics provided in fourth section complement to some extent the results presented in this section.

Suppose a household faces a set of four borrowing alternatives: both formal and informal, only-formal, only-informal, and non-borrowing. Furthermore, suppose the utility that household i obtains from borrowing alternative j has the following functional form:

$$U_{ij} = x_i'\beta_j + e_{ij} \tag{1}$$

where $x_i'\beta_j$ is the part of the utility known by the researcher that depends on household-specific characteristics, x_i; and e_{ij} is the random component that we assume to be independently and identically distributed in accordance with the extreme value distribution. These assumptions on the utility function and the distribution of unobserved components lead to the multinomial logit model (MLM). In our case, the MLM specifies that the probability that household j will choose borrowing alternative i is:

$$p_{ij} = \frac{e^{x_i'\beta_j}}{\sum_{l=1}^{4} e^{x_i'\beta_l}}, \quad j = 1, 2, 3, 4 \tag{2}$$

where β_l is vector of alternative-specific coefficients that have to be estimated.

In the MLM, logit probabilities exhibit the independence from irrelevant alternatives (IIA) property. The IIA property is not desirable especially when the alternatives are close substitutes. In our case, the fourth section partially demonstrates that in the village formal and informal loans have different contractual terms, are used for different purposes and hence can be hardly deemed close substitutes. This cannot be, however, assured when considering the substitution patterns between "both" and "only-formal," and between "both" and "only-informal."

Diagnostic testing for IIA includes Hausman and McFadden (1984) and McFadden *et al.* (1977), and related work of Bjorn and Vuong (1985), Small and Hsiao (1985) and Lien (1986). According to Train (1993), controlling for true probabilities not exhibiting IIA can be addressed by including a constant term as adjustment term in

the specification of the representative utility of each alternative. The logit choice probabilities therefore become:

$$p_{ij} = \frac{e^{\alpha_j + x_i' \beta_j}}{\sum_{l=1}^{4} e^{\alpha_l + x_i' \beta_l}} \quad j = 1, 2, 3, 4 \tag{3}$$

Estimates of the coefficients in Equation (3) are presented below.

Variables

All shocks discussed in fourth section are measured by dummies that take value 1 if the household reported the shock over the referenced time period. Furthermore, we allow for other household's characteristics by including a set of controls.

One control is the amount of aid-in-cash received (in ETB). On the one hand, local administrations (*kebelé*) in Ethiopia meddle with the distribution of aid since, despite being urged to use a set of selection criteria to determine which households are eligible, they rely on ample discretion in the selection process (Sharp, 1997). This can go hand in hand with how formal credit, and in particular MFIs' credit, is disbursed. Some Ethiopian MFIs indeed depend on local administrations for the selection of potential borrowers[22]. On the other hand, aid can produce disincentives to participate in the credit market. If aid-in-cash has liquidity and wealth effects on the beneficiaries, it can make the participation constraint more binding. For instance, Dercon and Krishnan (2003) show that in rural Ethiopia aid seems to crowd out local risk-sharing arrangements to some extent, even though aid itself seems to be barely shared among villagers.

In order to allow for risk and time preferences of households we also control for the number of household members. Other proxies for risk and time preferences, such as the age of household head, are not reliable in our case[23]. The number of household members is, however, highly correlated with age and other household's characteristics.

Other variables are included to control for the capacity to generate income and the level of wealth. The ability to repay and the access to investment opportunities can explain the participation in the credit market and the source of credit. The main source of income in rural Ethiopia is farming, and two rough measures of wealth are land and livestock holdings. We consider the size of land in terms of number of *timad* (equal to about a quarter of a hectare), a local unit of measure for land, and the size of livestock holdings in terms of Tropical Livestock Units (TLUs). Moreover, we include two dummy variables that allow for non-linearity in wealth. They take value of one if the household belongs to the poorest quartile in terms of either land holdings or livestock. It is worth noting that the accumulation of livestock is also a risk management strategy. Livestock as well as personal property in general can be accumulated during "good years" and depleted during "bad years." Yet when shocks occur at village level, such as drought, the livestock can be badly affected or the livestock market becomes saturated and many households are crowded out and barred from selling off their livestock (Dercon, 2002). For instance, two years before our survey was conducted, many oxen died because of drought.

It is also important to allow for networking effects. There is plenty of evidence that participation in social and economic organizations increases the probability of access to credit and in particular to formal credit (see for instance Wydick *et al.*, 2011; Okten and Osili, 2004). The associated social capital reduces transaction, searching, and screening costs. We include a dummy variable that takes value 1 if the household is

member of any *Iqqub*, that is the local ROSCA, and an indicator of social participation that measures the simultaneous participation in oxen sharing arrangements, labor parties, and cooperatives[24]. We have not allowed for the participation in *Iddir* since almost all surveyed households are members of at least one *Iddir*.

Table VIII provides definition and descriptive statistics of the variables considered.

Results and discussion

Results in Table IX show that several shocks are statistically and economically significant factors in determining the decision to borrow and the source of credit. Households affected by natural shocks behave differently according to the type of shock. However, differently from the univariate analysis, direct weather shocks such as heavy rainfall, landslides, and hailstorms are not statistically significant factors. Regarding the other natural shocks, being affected by crop pests and diseases increases the probability of borrowing from both formal and informal sources, and only-formal by 7.3 and 5.3 percent, respectively. In the village, pesticides can be purchased from either government or local suppliers. The cost represents a high lump sum for most households at average income. Further, according to interviews with some local stakeholders, the price of pesticides had dramatically increased over the years previous to the survey. Only formal lenders and moneylenders can provide sufficient credit to make up for such costs. The data indicates that having the field infested by dangerous weeds reduces the probability of borrowing from only-formal sources, by −8.8 percent, but increases the probability of borrowing from only-informal sources, by 5.3 percent. The latter effect is, however, not very statistically significant. Since farmers do not have access to herbicides, they uproot and destroy weeds during normal cropping seasons but weeds are difficult to control and eradicate once established in a field. Some weeds can also be dangerous for animals. Credit can therefore only be used to smooth consumption in case part of the crop fails or animals fall sick due to dangerous weeds. Yet some weeds are consumed as food when the agricultural production is endangered (Guinand and Lemessa, 2000).

Price shock variables are statistically significant for cash-trees, such as coffee, banana, mango or *enset* ("false banana"). The probability of borrowing from only-informal sources increases by 12.7 percent when households are affected by a large drop in cash-tree prices. Although this effect is not very statistically significant, it can be interpreted as a substitution effect between risk management strategies. Cash-trees are indeed a diversification strategies for farmers that are in the low land region of southern Ethiopia. When prices of cash-tree products go down households are forced to compensate consumption through alternative sources, such as credit.

Family shocks, and in particular the death of the family head, are important factors. Households where the head is passed away present a lower probability of borrowing from both and only-formal sources, by −10.1 and −12.0 percent, respectively, whereas their probability of not borrowing is higher, by 14.5 percent. These effects are very statistically significant and demonstrate how in the surveyed village the formal credit market in particular is male dominant. When the father dies and male children are too young to provide sufficient income though farming, mothers are forced to lend the field out. Income in female-headed households is lower and more uncertain than the rest of the village, meaning their ability to repay for a loan is therefore reduced. On the other hand, when a non-head member dies, the probability of borrowing from only-formal sources is higher by 14.8 percent.

Estimates for the variables of asset shocks show that the loss of farmland or theft reduce the probability to borrow from both and only-formal sources. Households that

Variable name	Variable definition	Mean	SD	Min	Max
d(Heavy rainfall)	1 = household affected by heavy rainfall; 0 = household not affected	0.734	0.443	0	1
d(Landslide)	1 = household affected by landslide; 0 = household not affected	0.249	0.433	0	1
d(Hailstorms)	1 = household affected by hailstorms; 0 = household not affected	0.330	0.471	0	1
d(Pests and diseases)	1 = household affected by plant pests and diseases; 0 = household not affected	0.625	0.485	0	1
d(Vermin)	1 = household affected by vermin; 0 = household not affected	0.335	0.473	0	1
d(Weeds)	1 = household affected by dangerous weeds; 0 = household not affected	0.556	0.498	0	1
d(Price input)	1 = household affected by large increase in input prices; 0 = household not affected	0.716	0.451	0	1
d(Price cash-crop)	1 = household affected by large decrease in cash-crop prices; 0 = household not affected	0.221	0.415	0	1
d(Price cash-tree)	1 = household affected by large decrease in cash-tree prices; 0 = household not affected	0.261	0.440	0	1
d(Price other)	1 = household affected by large decrease in other crop price; 0 = household not affected	0.115	0.319	0	1
d(Head died)	1 = household affected by death of family head; 0 = household not affected	0.149	0.357	0	1
d(Other died)	1 = household affected by of non-head member; 0 = household not affected	0.097	0.297	0	1
d(Head ill)	1 = household affected by illness of family head; 0 = household not affected	0.103	0.305	0	1
d(Other ill)	1 = household affected by illness of non-head member; 0 = household not affected	0.229	0.421	0	1
d(Theft)	1 = household affected by theft; 0 = household not affected	0.089	0.285	0	1
d(Loss of land)	1 = household affected by land seizing; 0 = household not affected	0.172	0.378	0	1
d(Fire)	1 = household affected by accidental fire or arson; 0 = household not affected	0.060	0.238	0	1
ln(Aid)	Log of amount of aid in cash received (in ETB)	3.487	3.099	0	9.904
ln(Family size)	Log of number of family members	1.781	0.432	0	3.091
ln(Land size)	Log of farm land holdings (in *timad)*	1.396	0.879	−1.386	3.695
d(Land25)	1 = household owns ⩽2 *timad* of land (first quartile); 0 = household owns more than 2 *timad* of land (first quartile)	0.266	0.443	0	1
ln(Livestock)	Log of livestock holdings (in TLUs)	−2.996	4.189	1.068	1.237
d(Livestock25)	1 = household owns ⩽2.025 TLUs (first quartile); 0 = household owns more than 2.025 TLUs (first quartile)	0.238	0.426	0	1
d(*Iqqub*)	1 = household is member of *Iqqub*; 0 = household is not member	0.172	0.378	0	1
Participation	Indicator of household's social participation (continuous variable)	0.000	1.001	−1.752	1.167

Table VIII.
Variable definitions and descriptive statistics

	Both	Only formal	Only informal	Non-borrowing
A. Natural shocks				
d(Heavy rainfall)	0.0524 (0.0380)	−0.0536 (0.0397)	0.0054 (0.0620)	−0.0042 (0.0607)
d(Landslide)	−0.0338 (0.0390)	0.0080 (0.0394)	0.0267 (0.0669)	−0.0009 (0.0664)
d(Hailstorms)	0.0234 (0.0406)	−0.0290 (0.0326)	0.0792 (0.0568)	−0.0737 (0.0559)
d(Pests and diseases)	0.0735(0.0337)**	0.0533(0.0319)***	−0.0850 (0.0577)	−0.0418 (0.0564)
d(Vermin)	−0.0236 (0.0382)	−0.0136 (0.0356)	0.0179 (0.0579)	0.0194 (0.0596)
d(Weeds)	0.0298 (0.0355)	−0.0883(0.0380)**	0.0992(0.0547)***	−0.0408 (0.0548)
B. Price shocks				
d(Price input)	−0.0506 (0.0443)	−0.0264 (0.0379)	0.0359 (0.0565)	0.0411 (0.0622)
d(Price cash-crop)	0.0003 (0.0495)	0.0702 (0.0493)	−0.0468 (0.0682)	−0.0237 (0.0748)
d(Price cash-tree)	−0.0318 (0.0451)	−0.0507 (0.0346)	0.1270(0.0706)***	−0.0445 (0.0714)
d(Price other)	0.0613 (0.0825)	−0.0041 (0.0530)	−0.1230 (0.0817)	0.0658 (0.0900)
C. Family shocks				
d(Head died)	−0.1011(0.0322)*	−0.1198(0.0162)*	0.0755 (0.0789)	0.1454(0.0775)***
d(Other died)	−0.0285 (0.0519)	0.1481(0.0711)**	0.0013 (0.0781)	−0.1209 (0.0774)
d(Head ill)	−0.0276 (0.0427)	0.0120 (0.0533)	−0.0643 (0.0881)	0.0799 (0.0904)
d(Other ill)	−0.0111 (0.0416)	−0.0036 (0.0434)	0.0566 (0.0623)	−0.0419 (0.0630)
D. Asset shocks				
d(Theft)	−0.0780(0.0320)**	−0.0757(0.0236)*	0.1468 (0.0910)	0.0069 (0.0955)
d(Loss of land)	−0.0853(0.0335)**	−0.0163 (0.0336)	0.0369 (0.0699)	0.0647 (0.0744)
d(Fire)	−0.0766 (0.0562)	−0.0413 (0.0519)	0.0161 (0.0982)	0.1017 (0.1091)
E. Controls				
ln(Aid)	0.0045 (0.0051)	0.0021 (0.0053)	0.0168(0.0084)**	−0.0234(0.0084)*
ln(Family size)	0.0594 (0.0437)	0.0667 (0.0460)	−0.0266 (0.0689)	−0.0995 (0.0684)
ln(Land size)	0.0130 (0.0239)	0.0019 (0.0270)	−0.0735(0.0426)***	0.0585 (0.0430)
d(Land25)	0.0576 (0.0644)	0.0097 (0.0533)	−0.1144 (0.0733)	0.0475 (0.0797)
ln(Livestock)	0.0217 (0.0178)	−0.0015 (0.0202)	0.0105 (0.0270)	−0.0307 (0.0275)
d(Livestock25)	0.0284 (0.0542)	−0.0968(0.0349)*	0.1058 (0.0741)	−0.0376 (0.0728)
d(*Iqqub*)	0.1890(0.0591)*	0.1491(0.0472)*	−0.1976(0.0604)*	−0.1405(0.0633)**
Participation	0.0426(0.0215)***	−0.0316(0.0182)***	0.02166 (0.0279)	−0.0327 (0.0274)
Number of observations	349			
Wald χ^2 (*p*-value)	1880.90 (0.0000)			
Pseudo-R^2	0.1629			

Table IX.
Multinomial logit: estimates of average marginal effects

Notes: Standard errors within brackets. *,**,***Statistical significance at 1, 5 and 10 percent levels, respectively

saw their land being seized have 8.5 percent less probability to borrow from both sources whereas those who suffered a theft have 7.8 and 7.6 percent less probability to borrow from "both" and "only-formal," respectively. In the first case, less land means less opportunities to invest which reduces the need for formal credit. In the second case, perhaps households become afraid of borrowing in cash because it would expose the family to another possible theft.

Regarding the controls, it is worth noting that social participation, in particular being member of *Iqqubs*, is an important determinant of the probability of borrowing from "both" and "only-formal" compared to borrowing from "only-informal" and "non-borrowing." *Iqqubs* are usually set up by wealthy households with ability-to-pay in order to buy high-value assets, such as *korkorò* (corrugated iron roof). Further, *Iqqub* dynamics resemble loan group's in microfinance. So, the pre-established organizational structure of *Iqqubs* favours the access to MFI's credit and other formal lenders' credit.

As for the other controls, aid does not seem to influence a household's borrowing decision, and wealth is particularly significant where measured by livestock holdings. Households that are in the lowest quartile in terms of livestock have 9.7 percent less probability to borrow from only-formal sources.

Joint effects and robustness to model specification

In Table X we replace the dummy variables of shocks with the shock indicators presented in fifth section. This specification allows the model to reduce the number of estimates and analyse unobserved joint or net effects of shocks within the same category. In order to further support consistency of results, in Table XI we report estimates of another model where the number of alternatives is reduced to three, that is only-formal, only-informal and non-borrowing, a common methodology employed by studies in credit choice analysis (such as in Beer *et al.*, 2010; Turvey and Kong, 2010; Mohieldin and Wright, 2000). The observations for "both" are split up randomly between "only-formal" and "only-informal."

Estimates of the first specification confirm that natural shocks, family shocks and asset shocks are important determinants of the credit choice. The joint effect of natural shocks on credit choice probability is very significant and positive for "both" whereas the joint effect of asset shocks is very significant and negative for "both" and positive for "only-informal." The joint effects of family shocks is negative for "only-informal" and positive for "non-borrowing." Further, the death of the family head remains an important factor as well as being member of an *Iqqub*.

The second model is not good in predicting choice probabilities, although the estimates support part of the previous results. Households that borrow from both formal and informal sources can have peculiar characteristics that are different from households that borrow from only-formal or only-informal sources[25].

Conclusion

Credit markets in rural areas of Southern Ethiopia are not complete[26]. Formal lenders, in particular, offer a restricted range of credit products, with greater average loan size and longer average maturity than the loans offered by the informal lenders. Terms of formal loans make them more appropriate to use for investment. In the surveyed village, formal loans are indeed more often used to finance trading activities and livestock raising. Informal lenders are observed to be more flexible and can easily provide loans to finance contingent needs of borrowers, but provide big size loans with a very high interest rate.

In the surveyed village, households are exposed and affected by many negative shocks. When negative shocks occur, such as the death of the family head or the seizing of land, this jeopardizes a household's ability to generate income or compromises the capacity to invest. We find that households facing negative shocks cannot easily access the formal credit market. However, if the loan can be used to control the negative effects of a shock, as for instance when plant pests and diseases spread, then formal credit plays an important role. There are networking effects that suggest some interaction between the formal and informal credit markets in terms of cross-lending, cross-selection and monitoring. These interactions, however, require further analysis. The formal credit market is gender based and also wealth particularly in terms of livestock holdings seems to affect borrowing behavior.

The study supports only to some extent the assumption that informal credit contributes to smooth consumption. According to the results, informal credit

Table X.
Multinomial logit (with shock indicators): estimates of average marginal effects

	Both	Only formal	Only informal	Non-borrowing
A. Natural shocks				
Indicator of natural shock (1)	0.0308(0.0147)**	−0.0251 (0.0154)	0.0320 (0.0252)	−0.0377 (0.0263)
Indicator of natural shock (2)	0.0112 (0.0170)	−0.0182 (0.0169)	−0.0006 (0.0264)	0.0076 (0.0275)
B. Price shocks				
d(Price input)	−0.0295 (0.0414)	−0.0386 (0.0395)	0.0276 (0.0576)	0.0405 (0.0606)
Indicator of produce price shock	−0.0032 (0.0158)	0.0114 (0.0143)	−0.0102 (0.0275)	0.0020 (0.0268)
C. Family shocks				
d(Head died)	−0.1067(0.0294)*	−0.1235(0.0175)	0.1002 (0.0784)	0.1301(0.0765)***
Indicator of family shock	0.0053 (0.0169)	−0.0130 (0.0165)	−0.0424(0.0250)***	0.0501(0.0256)***
D. Asset shocks				
Indicator of asset shock	−0.0644(0.0245)*	−0.0114 (0.0155)	0.0401(0.0239)***	0.0357 (0.0251)
E. Controls				
ln(Aid)	0.0068 (0.0052)	0.0024 (0.0057)	0.0149(0.0083)***	−0.0241(0.0083)*
ln(Family size)	0.0627 (0.0420)	0.0633 (0.0448)	−0.0386 (0.0704)	−0.0874 (0.0643)
ln(Land size)	0.0189 (0.0239)	−0.0111 (0.0270)	−0.0635 (0.0417)	0.0557 (0.0421)
d(Land25)	0.0629 (0.0661)	−0.0189 (0.0489)	−0.1001 (0.0736)	0.0561 (0.0795)
ln(Livestock)	0.0207 (0.0170)	0.0022 (0.0207)	0.0034 (0.0264)	−0.0263 (0.0265)
d(Livestock25)	0.0371 (0.0591)	−0.0926(0.0370)**	0.0946 (0.0754)	−0.0390 (0.0713)
d(*Iqqub*)	0.1818(0.0592)*	0.1462(0.0492)*	−0.1993(0.0619)*	−0.1287(0.0649)**
Participation	0.0368(0.0198)***	−0.0213 (0.0178)	0.0094 (0.0276)	−0.0249 (0.0274)
Number of observations	349			
Wald χ^2 (p-value)	1971.83 (0.0000)			
Pseudo-R^2	0.1265			

Notes: Standard erros within brackets. *,**,***Statistical significance at 1, 5 and 10 percent levels, respectively

	Only formal	Only informal	Non-borrowing
A. Natural shocks			
d(Heavy rainfall)	−0.0015 (0.0458)	0.0076 (0.0631)	−0.0061 (0.0609)
d(Landslide)	−0.0020 (0.0459)	0.0008 (0.0682)	0.0011 (0.0660)
d(Hailstorms)	−0.0357 (0.0412)	0.1059(0.0582)***	−0.0702 (0.0559)
d(Pests and diseases)	0.0848(0.0405)**	−0.0387 (0.0592)	−0.0461 (0.0560)
d(Vermin)	−0.0491 (0.0414)	0.0296 (0.0588)	0.0196 (0.0589)
d(Weeds)	−0.0814(0.0426)***	0.1226(0.0565)**	−0.0413 (0.0537)
B. Price shocks			
d(Price input)	−0.0254 (0.0445)	−0.0152 (0.0611)	0.0406 (0.0615)
d(Price cash-crop)	0.0588 (0.0559)	−0.0391 (0.0705)	−0.0197 (0.0740)
d(Price cash-tree)	−0.0304 (0.0457)	0.0718 (0.0723)	−0.0414 (0.0713)
d(Price other)	0.0194 (0.0746)	−0.0950 (0.0928)	0.0756 (0.0910)
C. Family shocks			
d(Head died)	−0.1430(0.0396)*	0.0161 (0.0765)	0.1269(0.0762)***
d(Other died)	0.1137 (0.0774)	0.0098 (0.0864)	−0.1236 (0.0775)
d(Head ill)	0.0094 (0.0654)	−0.0862 (0.0903)	0.0768 (0.0891)
d(Other ill)	−0.0052 (0.0515)	0.0477 (0.0639)	−0.0425 (0.0626)
D. Asset shocks			
d(Theft)	−0.1443(0.0300)*	0.1582(0.0946)***	−0.0139 (0.0947)
d(Loss of land)	−0.0697(0.0385)***	0.0046 (0.0709)	0.0651 (0.0734)
d(Fire)	−0.0725 (0.0554)	−0.0300 (0.0999)	0.1025 (0.1095)
E. Controls			
Ln(Aid)	0.0005 (0.0062)	0.0225(0.0087)*	−0.0231(0.0083)*
Ln(Family size)	0.1146(0.0543)**	−0.0093 (0.0714)	−0.1053 (0.0691)
Ln(Land size)	0.0107 (0.0302)	−0.0682 (0.0428)	0.0575 (0.0432)
d(Land25)	0.0781 (0.0711)	−0.1237 (0.0771)	0.0456 (0.0805)
Ln(Livestock)	0.0025 (0.0217)	0.0250 (0.0284)	−0.0275 (0.0275)
d(Livestock25)	−0.1060(0.0507)**	0.1420(0.0747)***	−0.0360 (0.0737)
d(*lqqub*)	0.2665(0.0584)*	−0.1339(0.0676)**	−0.1326(0.0628)**
Participation	−0.0302 (0.0220)	0.0603(0.0286)**	−0.0301 (0.0272)
Number of observations	349		
Wald χ^2 (*p*-value)	74.10 (0.0150)		
Pseudo-R^2	0.1338		

Notes: Standard erros within brackets. The observations for "both" were split up randomly between "only-formal" and "only-informal". *,**,***Statistical significance at 1, 5 and 10 percent levels, respectively

Table XI.
Multinomial logit (without alternative "both"): estimates of average marginal effects

borrowing decisions respond only to drops in cash-tree price, an important source of cash income for Ethiopian households. A model that would consider dynamic consumption patterns would have been more appropriate. In fact, one of the limitations of the study is the reliance on a cross-section analysis and the data is limited to just one village. Further research would extend the data set geographically and across time.

In terms of policy, the study suggests several propositions. In order to increase outreach to rural borrowers the formal lenders, and in particular MFIs, have to develop credit products that are more flexible in contractual terms and tailored to a wide range of clients, with both consumption smoothing and investment needs.

First, flexibility implies that the loan size and duration should be appropriate to the ability-to-pay and agricultural and business cycle of each farmer. In the village considered, the MFIs provide standardized loans according to the type of investment stated by the farmer. However, most of farmers used the money received for different

purposes. Some of them directed the funds to consumption only. This hints at the argument that money is fungible (Adams and Von Pischke, 1980) and its uses are difficult to monitor. It follows that credit products have to be designed accordingly. In this regard, the informal credit market, where credit products are exceptionally flexible, is more complete than the informal one.

Second, farmers should have access to credit in the aftermath of a negative shock and be able to finance proper risk management strategies when a risk is perceived. In rural Ethiopia, the informal market can play only part of that role. Its capacity is limited when the shock is somewhat covariant and the market breaks down when the shock is systemic. On the other hand, the formal lenders are not willing to provide contingent loans, maybe because of the lack of proper risk transfer strategies and instruments. The empirical analysis shows how formal credit is hardly responsive to shocks, especially to natural shocks. Besides, the available formal credit products are not proper to finance long term risk management strategies but pesticides, fertilizers and improved seeds that are entirely used in every agricultural cycle.

Notes

1. The GDP datum is from http://databank.worldbank.org/databank/download/GNIPC.pdf (accessed November 23, 2012).
2. Data from www.cia.gov/library/publications/the-world-factbook/geos/et.html (CIA, *The World Factbook*) and http://data.un.org/CountryProfile.aspx?crName = Ethiopia# Economic (UNdata) (accessed November 23, 2012).
3. Besides MFIs, savings and credit cooperatives are also expanding their activities in rural areas as discussed below.
4. Exchange rate EUR/ETB on the July 7, 2011 (end of the Ethiopian FY): EUR 24.4313.
5. The break-even point is at 100 percent.
6. The literature on ROSCAs is vast.
7. There are also Iddirs with hybrid agreements.
8. Price risk entails both input and out prices.
9. Data and information provided by a local NGO, GMA Onlus.
10. Data and information provided by a local NGO, GMA Onlus.
11. One government MFI and one private MFI.
12. Around 15 percent of observations have no reference to the type of formal lenders.
13. These results are to be taken with great caution. An analysis of uses of loans indeed suffers from the money fungibility pitfall (Adams and Von Pischke, 1980).
14. Apart from the death of the family head, family shocks are believed to have short-term impacts.
15. Viganò *et al.* (2007) focus on coffee growers.
16. The difference with the "both" households is also positive, 7 percent, but is not statistically significant.
17. In an analysis on the same data, not reported here, we find that poorer households are less exposed to both natural and produce price shocks. As for crop diversification, raising also beans reduces exposure to natural shocks whereas raising cotton highly increases exposure to price shocks. Viganò *et al.* (2013) provide similar conclusions from a theoretical perspective.

18. The MFIs that operate in the surveyed area only requires personal guarantees. Furthermore, in Ethiopia, all land is owned by the government who provides long-term leases to the tenants. In case, an household's land can be sized for road building or other infrastructures.
19. We employ a Burt method and principal inertias (eigenvalues of the Burt matrix) are adjusted as in Greenacre (1984).
20. The inertia of a component reflects the relative importance of such component. That is tantamount to the percent of variance explained.
21. In this case, indicators are normalized between 0 and 1 for the sake of interpretation.
22. An interview with a village leader revealed that this sort of administrative "meddling" is also enforced to some extent when a microfinance intermediary wants to start operating in the kebelé area.
23. Many interviewees were illiterate and age, for instance, is not indeed the true age but a guess.
24. This indicator was built thug multiple correspondence analysis. 75% of the inertia is explained.
25. We estimated also a set of individual (binary) Logit models where each alternative (both, only formal, only informal and non-borrowing) is run against the other alternatives all together. Even though with differences, most of the results in terms of both economic and statistical significance are almost tantamount to the results we found with the Multinomial Logit model.
26. For a comprehensive theoretical discussion on completeness in financial markets see Flood (1991).

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