

# COMMODITY PRICES AND MARKET INSTITUTIONS IN ETHIOPIA

Råvarepriser og markedsinstitusjoner i Etiopia

Philosophiae Doctor (PhD) Thesis

Getaw Tadesse

Department of Economics and Resource Management  
Norwegian University of Life Sciences (UMB)

ÅS 2010



Thesis number: 2010:14  
ISSN: 1503-1667  
ISBN: 978-82-575-0926-2



## **Acknowledgment**

The research reported in this thesis was carried out at the Department of Economics and Resource Management (IOR), Norwegian University of Life Sciences and Department of Agricultural Resources Economics and Management in Hawassa University. Many people and organizations have directly or indirectly contributed towards the realization of the thesis. I would like to express my appreciation and gratitude to few of them. First, I wish to express my sincere appreciation to my supervisor Prof. Atle Guttormsen, for his support and guidance throughout the dissertation work. Secondly, I am deeply grateful to my co-supervisor Prof. Gerald Shively, without his assistance materializing this thesis would have been very difficult. Besides the invaluable comments on draft papers, he has hosted my research visit to the Department of Agricultural Economics at Purdue University. I had also enjoyed his family's company while I was very far from home. I wish to express my appreciation to the wonderful family. I also wish to thank Prof. Frank Asche for reading my draft papers and his willingness to help me in any way required.

My sincere appreciation shall go to staffs and friends at IOR. Stig Danielson and Reidun Aasheim deserve special thanks for their unreserved assistance while I was stuck technically and administratively. I have many thanks to the staff members at the front desk of the department for their kind services. I am grateful to my PhD colleagues Hosa'ena, Maren, Alex, Rodney, Sosina, Anbes, Daniel, Herbert, to mention few, with whom I have enjoyed discussing draft papers, contemporary topics and other social events.

I am grateful to Dr. Yewlsey Abebe, Dr. Worku Tesema and Thomas Lemma who helped me for conducting fieldwork and data entry in Ethiopia. I am also indebted to my friend Dambala Gelo for his encouraging discussion we had on the research topics. My special thanks go to Dr. Fikre Mamo for the wonderful time we had together during my stay in Awassa.

My stay in Norway was partly motivated by the loving Ethiopian community in and around Skogveien and other friends in Oslo. Though naming all the fascinating people in these areas is difficult, I am deeply thankful for the time we had together. Alem and Alex

and their lovely daughter Sara deserve special gratitude for their hospitality, encouragement and company to me and my family.

Above all, I wish to express my deepest gratitude for my dearest wife Ledia Nadew who did everything at your stake this to happen. You had forgone your honey moon while I have to leave to US for research visit immediately after our wedding. You also abandoned your study back home to accompany me here in Norway. The lonely times when I was on confused state of thought are the additional debts that I owed to you. I am also indebted to our lovely daughter Amen Getaw for her unreserved smile and hug she fed me during my final works. I greatly thank the family for your understanding. I am also pleased to my mother Aberash Mandefro, my father Tadesse Gebreyohanes and all my brothers and sisters without whom I would not have gone thus far. My late sister Tigist Tadesse has special place in my heart as I have lost her at the start of this work.

Finally, I wish to acknowledge the Norwegian university of Life sciences and the Norwegian tax payers for financing this study through the quota program of the Norwegian loan fund (Lånakessen).

Getaw Tadesse

Ås, March 2010

## Table of Contents

<b>Introduction: Commodity Prices and Market Institutions in Ethiopia .....</b>	<b>3</b>
Introduction .....	3
Commodity market in Ethiopia .....	4
Food demand and supply .....	5
Price trend and volatility .....	7
Market structure .....	9
Policy reforms .....	11
Theoretical frameworks .....	12
Price formation and smallholders' response .....	12
Price risks .....	15
Market imperfections .....	17
Market institutions .....	18
Research questions and objectives .....	20
Summary of findings and recommendations .....	22
<b>Paper-I: Food Aid, Food Prices, and Producers' Disincentives in Ethiopia .....</b>	<b>33</b>
<b>Paper-II: Speculation and Commodity Price Dynamics in Ethiopia .....</b>	<b>49</b>
<b>Paper-III: Interlinked Contracts and Smallholders' Commercialization: Evidence from Southern Ethiopia.....</b>	<b>83</b>
<b>Paper-IV: Clientelism among Smallholders' and Grain Traders in Ethiopia: Opportunity or Threat? .....</b>	<b>123</b>



# Introduction





# **Commodity Prices and Market Institutions in Ethiopia**

## **Introduction**

Transforming a subsistence economy to market-oriented economy is a challenge for many developing countries. The movement towards market-orientation requires improvement in the efficiency of production and marketing systems. An improvement in the efficiency of a market system can increase producers' productivity and reduce food insecurity. Markets allow people to reallocate their skills and resources according to the logic of comparative advantage, oftentimes leading them to engage in activities with higher levels of productivity than their former activities (Pingali, 1997, Timmer, 1997, WDR, 2008). At least since Adam Smith, economists have seen that trade provides a foundation for specialization and a vast expansion in human productivity as a result of division of labor. It is the presence of market opportunities that permits one person to grow corn, another hogs, the baker to bake and the butcher to cut meat, as each specializes in that for which he is suited by temperament, experience or natural skills, then satisfies his general needs through markets.

Properly functioning markets help to match supply and demand between locations and across seasons, benefitting producers by increasing the number and frequency of sales outlets. At the same time, markets benefit consumers by improving access to and availability of food. Amartya Sen, the 1998 winner of the Nobel Prize in economics has articulated the role of the market in supporting livelihood and averting famine. According to Sen, a lack of income entitlement and poor market access are the major reasons for famine -- rather than low production, as is often assumed. An efficient market system distributes food from surplus areas to deficit areas and thereby can make food more affordable to low-income

consumers. It also brings down the real cost of food by reducing marketing costs. Since the majority of the population in Africa depends on food production and marketing and getting foods from producers to consumers carried out through tiny transactions, the potential livelihood and food security effects of improving market performance is likely more substantial in Africa than elsewhere.

However, the current performance of most African agricultural commodity markets is very weak and perhaps dysfunctional for farmers- the major actors in the food supply system. These markets are marred by uncertainties and imperfections, both of which retard the process of economic and agricultural transformation. Such problems are especially acute in Ethiopia, because of the poor infrastructures, ineffective market institutions and frequent structural changes. The purpose of this thesis is to evaluate the performance of Ethiopian agricultural commodity markets in terms of their robustness to internal and external shocks and the efficiency of the markets' institutions. The thesis is a collection of four self-contained research papers, each addressing a different issue. The main objective of this chapter of the thesis is to lay out the issues of current concern in policy debates regarding commodity markets. The chapter provides background information about commodity marketing in Ethiopia and theoretical concerns surrounding commodity markets in less developed economies. This overview creates the setting for the individual analyses undertaken in subsequent chapters.

### **Commodity markets in Ethiopia**

The market for grains is the largest of all commodity markets in Ethiopia, both in terms of the volume of output handled and the number of market participants. Many millions of farmers, consumers, and marketing agents participate in the production, distribution, marketing and consumption of food grains. The major grains widely produced and marketed

include teff<sup>1</sup>, maize, wheat, sorghum, peas, beans and oilseeds. The following subsections explain the fundamental features and structures of the markets for these grains.

#### *Food demand and supply*

Global food demand is expected to double by the year 2050 (Thompson, 2007). These increased food needs largely comes from developing countries. The demand for food in Ethiopia is continuously rising as a result of a high population's growth rate – currently 2.6% -- and rapid urbanization. An increase in urbanization, in particular, increases consumer demands for highly processed and differentiated food products, and therefore a higher demand for both the quantity and quality of foodstuffs. The use of agricultural products for bio-fuel production may also exacerbate the rising demand for agricultural commodities (FAO, 2008).

Contrary to demand, the country's food supply is growing very slowly. Using historical records of FAO, we estimated the level of grain production and per capita grain supply for the periods 1980-2005 (Table 1). The record shows that grain production over this period grew by about 3.7% annually. There has been an improvement in growth rates over decades. Negative growth in the 1980s was turned to 7% growth in early 2000s. These growth rates are, however, very volatile. For example, 35% increase in 1996 is followed by 0.8% increase in 1997 and a further decline by about 23% in 1998. The worst thing is that the average variability of grain production remains unchanged over decades. The records, generally, implied that the growth of food production is not yet dependable and the source of this blink growth is predominantly good weather. The country easily immerses in acute food shortage with a delay in rainfall for a single season.

---

<sup>1</sup> Teff is a small cereal grain that grows only in Ethiopia. It uses to make the major stable food called Injera. It is the first largest crop in terms of area coverage and the third largest crop in terms of total production next to maize and wheat.

Surprisingly, the average per capita food supply is not lower than the requirement. According to FAO, the annual grain equivalent requirement for an adult is about 135 kilograms, which is lower than the average of all times (Table 1). However, Ethiopia imports about 10% of the total domestic cereal production every year in the form of food aid. Had it not been any data error, this paradox must be explained by the inefficiency of markets and non-market institutions that have to bridge deficit areas and times. If the total supply is enough to feed the population, the issue should remain on distribution rather than production. Distribution over time and space require efficient markets that could generate the right price signal to move resources from surplus areas and periods to deficit areas and periods. The issue has been well recognized since the work of Sen who claims famine is more about entitlement than availability (Devereux, 1988). Whenever famine is motivated by lack of entitlement, the culprit will be the efficiency and effectiveness of the existing marketing systems.

**Table.1. Food grain production and per capita supply in Ethiopia**

	1980s	1990s	2000s	1980-2005
<b>Annual Production</b>				
Mean (million tone)	6.392	7.646	12.100	8.474
CV	0.136	0.231	0.198	0.345
Growth rate (%)	-0.6	5.2	6.8	3.7
<b>Per capita supply</b>				
Mean (kg/person)	142	127	161	142
CV	0.198	0.186	0.143	0.196
Growth rate	-0.037	0.026	0.041	0.010

*Source: FOA data base, Data in 1980s includes Eretria as part of Ethiopia.*

**Table 2. Marketed surplus of major crops estimated by different studies, in percentage**

Crops	1995*	2005**	2008***
Maize	23	8	31
Wheat	27	17	25
Sorghum	21	9	20

Source: Rashid, et al.(2008)

\* Michigan State University Grain Marketing Research Project survey in 1995

\*\* IFPRI Commercialization Survey in 2005

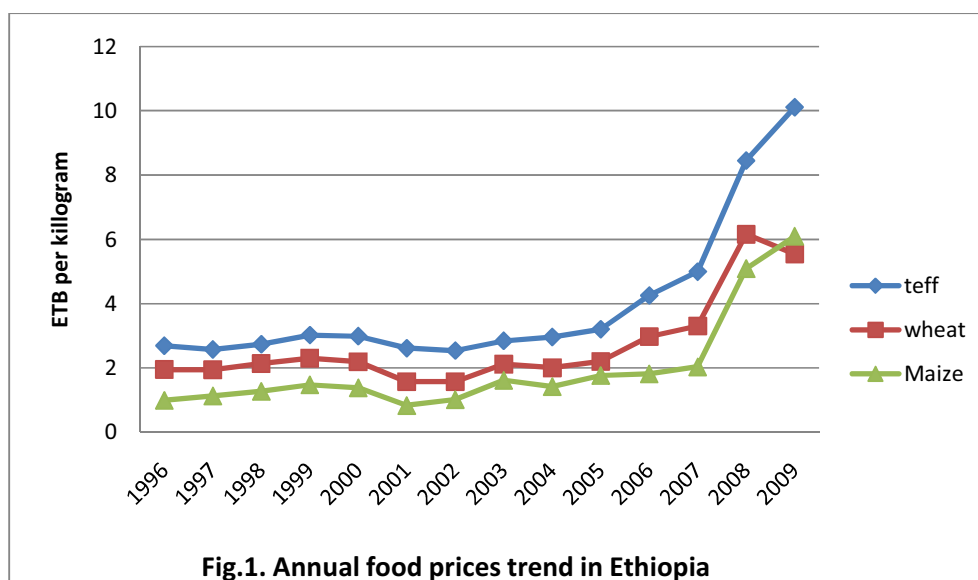
\*\*\* IFPRI Ethiopian Agricultural Households and Markets Survey Estimate in 2008

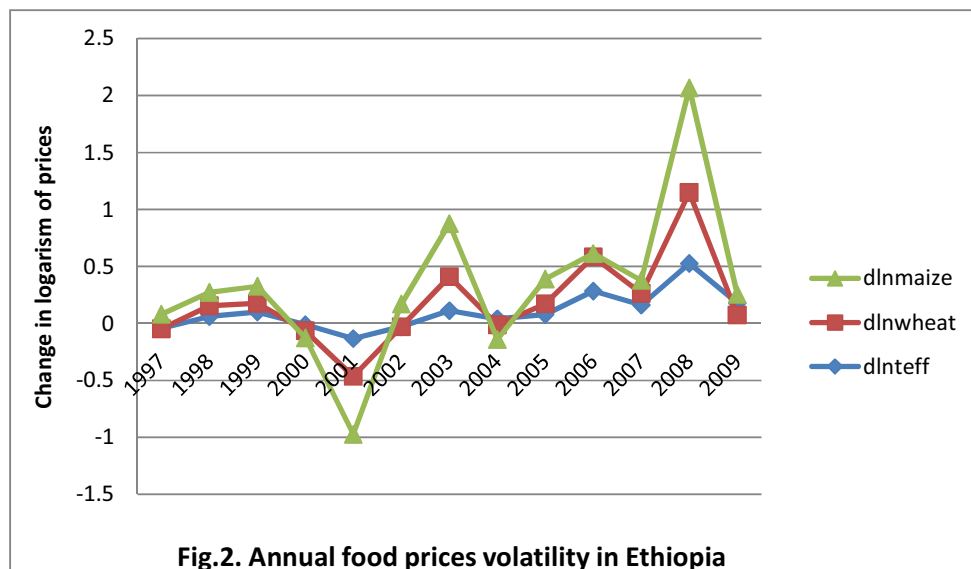
The proportion of grains supplied to the market by smallholder producers is also very low. Following the production potential, the size of marketed surplus varies across regions and periods. According to the information collected by the Ethiopian Cereal Availability Study team (Rashid, et al., 2008), the average marketed surplus for three major cereals such as maize, wheat and sorghum ranges from 8-31% (see table 2). The 2006 survey for this thesis in southern Ethiopia, relatively surplus region, indicated a marketed surplus of 37% for major cereals such as maize, *teff*, and wheat. All these show that smallholders' commercialization measured by the proportion of output supplied to the market remains low.

#### *Price trends and volatility*

Ethiopian food commodity prices exhibit neither downward nor upward until the 2006-2008 shocking commodity price rise (Figure 1.). This could be viewed as favorable for producers from the declining world commodity price perspective. However, in a country where the economy is entirely dependent on agriculture, agricultural price stagnation could translate to economic stagnation. Despite the historical flat trend, the magnitude and consequences of the recent commodity price rise was very severe. As we can see from the figure, the price boom started in 2006. In 2006, the price of all food grains in all markets

increased as much as 80% (MoARD, 2006). However, a more disturbing food price increase was observed in 2008 when most prices increased as much as 150%. Many explanations have been given for the cause of Ethiopian food price rise (see Loening, et al., 2008). Some of them are expectation of traders, world food price increase due to bio-fuels, excessive money supply, increase in government spending, increase in income of the consumers (economic growth), untimely and excessive government intervention through cooperatives and rise in cost of food production. The welfare impact of this boom on consumers and producers is being debated. A recent study by Ulimwengu, et al.(2009), indicates that rural households experience higher calorie intake loss than urban households. von Braun (2008) et al. point out that net food exporting countries would have been benefited from improved terms of trade, though they are missing it by banning food exports. Net food importing countries faces hard time to meet domestic demand. A study by Wodon and Zaman (2009) in Sub-Saharan Africa indicates that rising food prices are likely to lead to higher poverty as the negative impact on net consumers outweighs the benefits to producers.





Ethiopian food prices are subject to significant and continuing inter-annual price volatility that may rank among the highest in the developing world (Figure 2). The annual coefficient of variations for major food crops ranges 52 to 78% between 1996 and 2009. Monthly price instability, an indication of a market's relative performance in realizing arbitrage opportunities, has also worsened in the most recent period (see chapter 2). The prices for crops of the poor (predominantly maize and wheat) are more variable than the prices of crops of the well-off (teff). The adverse effect of this volatility both on producers and urban poor consumers was tremendous. For example, a substantial price collapse in 2001 resulted in a situation where many farmers were unable to cover even their fertilizer costs. Likewise, the 2008 price hike caused consumers to be unable to feed themselves.

#### *Market structures*

Both the four-firm concentration ratio (CR4) and Gini coefficient indicate that Ethiopian grain market has fairly low market concentration. Using the national grain traders' survey of GMRP, Dessalegn, et al (1998), estimated CR4 ratio for major regional markets and commodities. The result indicates that the degree of inequality in market share widely varies

across markets and crops. The ratio ranges from 3% to 56%. For most markets and crops the CR4 is less than 33%. Amha, (1994) has estimated an average ratio of 35% for a local market in southern Ethiopia. In general, the four firms' ratio showed that close to one third of the total grain supplied in a market is handled by the four largest traders in that market. A market with a CR4 more than 33% is considered to be oligopolistic. The same studies indicate that a typical Ethiopian market exhibits a Gini coefficient that ranges from 0.46 to 0.56.

Entry barriers to a market could be government regulations, investment cost, scale factors, strategic coordination and networks. Of greater importance in Ethiopian commodity markets are investment costs and networks. Many regulatory barriers such as grain quotas, price controls, etc. have been lifted since the 1990 market liberalization. Currently, the major entry barriers both for the buyers and sellers are informal transactions (clientelism), large amount of start-up capital, and excessive risks without effective credit and insurance markets to deal with it. Grain trading in the central market is unthinkable without the use of informal brokers who have strong network with the incumbent traders. Producers sell their products only to those who have strong social relations. These informal transactions may limit new traders to engage in commodity trading.

Ethiopian food markets are predominantly operated by smallholder producers, small wholesalers, tiny retailers and poor consumers. Their functional relationship and individual behavior is very complex to characterize. However, a widely accepted fact is that the bargaining power is much skewed towards assemblers and wholesalers. This is mainly because traders have better access to information, insurance and capital markets. Furthermore, some studies revealed that both traders and producers in Ethiopia operate sub-optimally (Dadi, et al., 1992, Dessalegn, et al., 1998, Gabre-Madhin and Amha, 2005).



Producers sell most of their grains at harvesting time when prices are low. Traders invest very little on marketing facilities (storage, processing, etc.) and future trading.

Motivated by lack of access to market services, few institutional arrangements are emerging. These are marketing cooperatives, contracts and brokerage. The role of these institutions in exchange enforcement and creating incentive to exert higher effort is not very clear. While brokerages are found to be pivotal in facilitating exchange, cooperatives are less effective in creating incentives for producers. A study made by Gabre-Madhin (2001) in Ethiopian central grain market confirmed that brokers reduce traders search cost and increase total welfare by about 60 percent. Another study made by Bernard et al. (2007) showed that the existing cooperatives have no significant impact on the level of marketed surplus supplied by small producers.

#### *Policy reforms*

Many institutional and policy reforms have been carried out in Ethiopia to improve the efficiency of food commodity markets. Following the 1990 general economic reform, agricultural markets were liberalized from fixed price, quota and government dominated system to a more relaxed free trade and active involvement of private traders. Government marketing board, Agricultural Marketing Corporation (AMC), was reorganized and renamed as Ethiopian Grain Trade Enterprise (EGTE). Grain trade restrictions were lifted. Prices were left for free market determinations. After the 1990 market liberalization until the grain market collapse in 2001, government policy intervention was very limited. However, the 2001 price slump urges the government to take actions that can improve the market and the net price received by producers. Thus, the EGTE was strengthened and its mandate was restated (Bekele, 2002). The Enterprise has given a mandate of exporting food grain to neighboring countries. Farmers were also encouraged to organize cooperatives. Rural

infrastructures were given special emphasis to connect producer markets to central consumer markets.

The government has also embarked a program called Plan for Accelerated and Sustained Development to End Poverty (PADESP) in 2005 to increase smallholders' integration to markets and enhance marketed surplus. The program constitutes establishment of value chains, market information centers and marketing cooperatives. The program has initiated market-oriented production and specializations of regions on specific commodities.

Following the 2006 food price hike, grain exports were banned, imported grains were distributed through public shops at lower prices, and traders were closely supervised for their inventory holding actions. Export of specialty foods such as teff and green paper was a lucrative business due to increased Ethiopian population living outside of the country. However, teff export has officially banned to reduce the ever increasing domestic price. More recently, commodity exchange market (ECX) has been established to formalize informal grain marketing procedures and upgrade the performance of the marketing system. Though the ECX has vision of revolutionizing the Ethiopian agriculture through a dynamic, efficient, and orderly marketing system that serves all, many believe that it is politically motivated and loaded (Gabre-Madhin, 2007, Hassan, 2009, Mezlekia, 2009)

## **Theoretical frameworks**

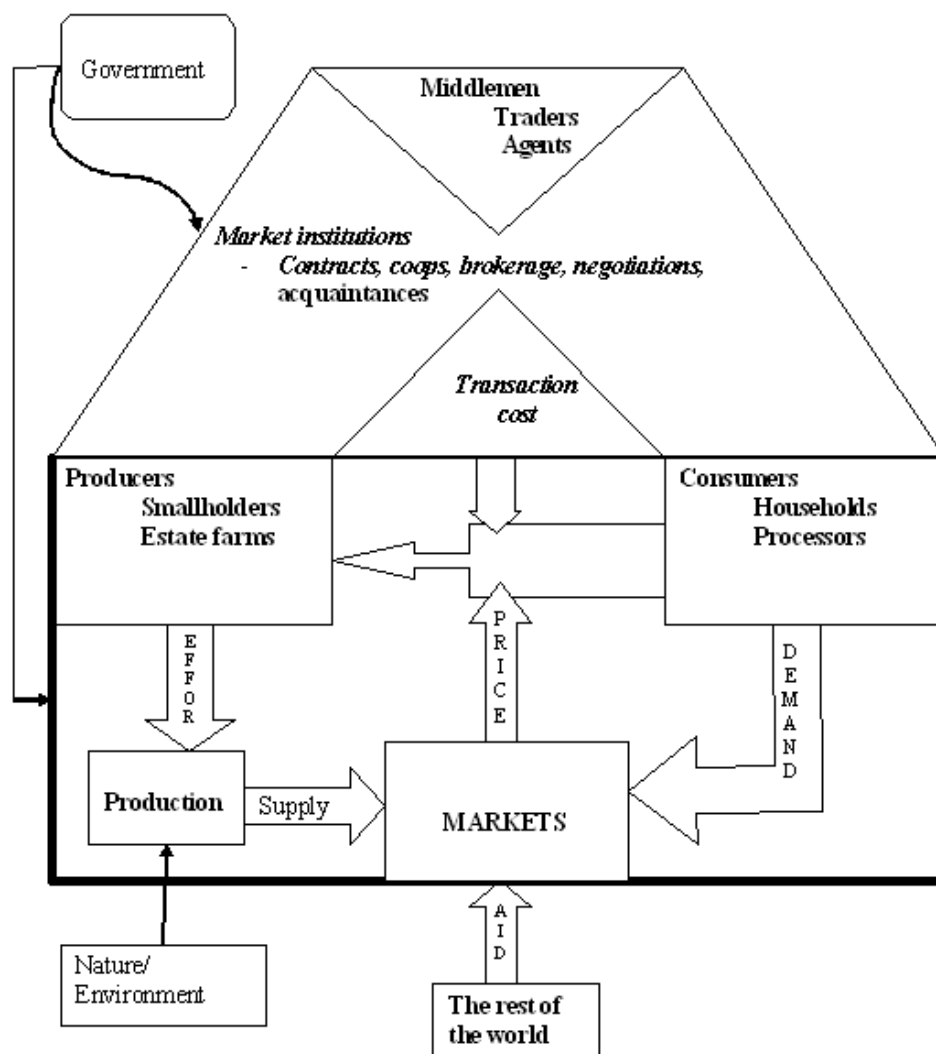
### *Price formation and smallholders' response*

Building upon the empirical concerns outlined above, this sub-section summarizes the key relationships governing the performance of food grain markets. There are two major approaches to the study of market performance: the first approach, the structure-conduct-performance framework, is primarily descriptive and provides an overview of the market's organization. According to this approach, a market's performance depends on the conduct

of its firms, which then depends on the structure of the market. The structure of the market then depends on basic conditions, such as supply and demand for a product. The second, price theory, uses microeconomic models to explain firm behavior and market structure. In both approaches, the efficiency of the market is measured by the difference between marketing margins and marketing costs. The margins and costs, in turn, depend on the level and movement of prices and the efficiency of institutions that govern the behavior of prices and costs. Although conceptualizing this process in a stylized framework is very difficult, Figure 3 summarizes the theoretical links between price formation, establishment of institutions and smallholders' decision.

In a perfect market where transactions are costless, exchange takes place through the interplay of demand and supply as is indicated in the lower loop of Figure 3. In this case, institutional complexities are not relevant in explaining behaviors. External shocks to demand and supply would be the prime factors for the movements of prices. Prices paid by the consumers and received by producers would be the same. The arrow that goes from consumers to producers would not be broad at its bottom and narrow at its tip. However, if markets are imperfect and characterized by large transaction costs, as is in real life, institutional arrangements will arise to bring consumers and producers together. The upper loop of the figure would come to the scene. This loop captures the interaction between producers, middlemen and consumers. They interact in different modalities such as through cooperatives, contracts, brokerage, informal relations etc. The functions and strength of these institutions determine the nature and extent of transaction cost that pushes the producer price down. The more strong institutions, the lesser the transaction cost and the smaller size of the triangle that contains this cost. Then transaction cost becomes less powerful to drive the producer price down. The producer price therefore will be a function

of the market price and the transaction cost. Markets provide incentives to smallholders if the market price is high and stable and the transaction cost is minimal. This incentive is a key factor for producers to put in higher efforts in the production of food that ultimately benefits the entire economy.



*Fig3. Price formation and smallholders' response in an imperfect commodity market*

Some of the external factors that affect the level of market prices and transaction costs are government policies, nature and interactions with the rest of the world. Government affects the working of institutions and the basics (demand and supply) either through

creating incentives or making direct regulations. Nature imposes both opportunities and constraints in smallholder agriculture (Binswanger and Rosenzweig, 1986). An important area of cooperation with the rest of the world is food aid. Ethiopia receives a large share of food aid both as emergency and program aid. The humanitarian relevance of these forms of assistance is undeniable. The potential long-term impact of this aid on agricultural development, by depressing local markets and creating disincentives for producers, may be very important.

From the above stylized commodity market, further explanations are required on prices risks, market imperfections and market institutions.

#### *Price risks*

The effect of price risk on consumers' and producers' welfare has been widely debated (Newbery and Stieglitz, 1981, Sadoulet and deJanvry, 1995, Sahn and Delgado, 1989). On average, price risk reduces producers' input use and investment, and consumers' expenditure. However, the actual welfare effect depends on agents' ability to predict price trends, trace the sources of volatility and identify effective ways of stabilizing prices.

In an attempt to predict trends of agricultural commodities, two contrasting perspectives prevail. The classical economists' view presumed that primary commodity prices should have an increasing trend. This is because primary commodities are produced using the fixed resources such as land that limits their supply. Moreover, technical progress in primary sector is slower than secondary and tertiary sectors. Noting that the primary sector is a supplier of food and raw material to the fast growing sectors, prices are expected to rise. The other view stems from the inelasticity of demand for primary commodities. Since the demand for these goods is very inelastic, prices should trend downward over time.

Identifying the sources of price volatility has been a major area of theoretical and empirical concern for a long time. Two major strands of theory are common in characterizing price volatility for a storable commodity. These are the random walk hypothesis and the rational expectation hypothesis. The random walk hypothesis asserts that price shocks are stochastic and somehow natural. Shocks related to the supply of agricultural commodities such as rainfall, pests, diseases outbreaks, etc. are the major sources of price volatility. The rational expectation hypothesis associates price volatility with that of expectations and speculations. In this view, the presence of speculation and storage leads price movements to deviate from a random walk (Williams and Wright, 1991). Thus, price shocks behave differently in downward movements and upward movements implying that price volatility is a rationally induced behavior.

Traditional welfare analysis at a micro level concludes that the economic benefits of price stabilization for producers or consumers are very small. However, the high welfare cost of price volatility leads many governments to pursue price stabilization in various ways. Using buffer stocks to maintain price within a range defined by a ceiling and floor price is widespread form of stabilization. Trade policies that liberalize and restrict import and exports are also common instruments for mitigating price hikes and slumps. Some governments go to the extent of directly regulating markets by fixing prices and monitoring private inventory schemes. The welfare impacts of price stabilization policy depend on the elasticity of demand, variability of production, risk aversion, and the dynamics of private storage (Islam and Thomas, 1996, Newbery and Stieglitz, 1981, Sadoulet and Janvry, 1995). If the price elasticity of demand is less than one, which would be the case for agricultural commodities, price stabilization decreases the average income received by farmers. Price stabilization can result in high benefits for producers and consumers when risk aversion is

very high. If inventory holding speculators are risk-neutral and competitive, public storage may not result in aggregate improvements in welfare.

### *Market imperfections*

Market imperfection is anything that interferes with free trade. Imperfections are widespread in underdeveloped economies (Barrett and Mutambatsere, 2005, Holden, et al., 2001). They are everywhere except that the degree varies across markets depending on the level of physical infrastructures, policy failures, nature of transactions and transacting parties. Though product markets relatively function better than factor markets, they are far from being perfect. Property rights are not yet fully protected. Transaction costs caused by the tiny nature of transactions, smallness of buyers and sellers and information searching are still excessive and prohibitive (Fafchamps, 2004). Smallholder farmers face very uncertain production and marketing environments that raise production and marketing costs. Using the data from grain market research project survey in Ethiopia, Dessalegn, et al. (1998) have estimated that marketing costs account for 40-60% of the total price spread between producer and retailer prices. Apart from this explicit cost, implicit costs related to price risks, disincentives caused by external interventions, marketing malpractices such as cheating, theft, searching etc. and asymmetric bargaining power are often large.

As a result of market imperfections, markets either fail or become thin or exclude some potential market participants. Some markets may function for a certain period of time or until the level of demand reaches to certain level. But when the level of imperfections outweighs the gain from trade or exchange, markets presumably fail. Market failure causes smallholders to produce very limited range of goods and services mainly for home consumption. It also constrains them to apply low level of external input and become less responsive to market changes (Holden, et al., 2001, Sadoulet and Janvry, 1995). Hence,

farmers could not realize the gain from trade and able to maximize annual farm income through specialization according to long term comparative advantages. Market imperfection also reduces the impacts of policy and technological changes. A policy change brings lower impact on desired goals and actions in areas where markets are imperfect than in areas where markets are perfect (deJanvry, et al., 1991). The same reasoning holds true for the impacts of technological change.

Whenever markets are characterized by imperfections and farm households cannot participate, their production and consumption decisions become non-separable (deJanvry, et al., 1991, Singh, et al., 1986). The practical implication of non-separability is that production and marketing decisions are made based on a price endogenous and specific to each decision making unit. As a result, decision making depends more on resource endowments than market prices. For example, in an area where a credit market is imperfect, a household's cash endowment may be more important to decisions about input use or marketing than the interest rate.

#### *Market institutions*

Market institutions are sets of rules and strategies that facilitate exchange among and/or between market participants (producers, consumers, middlemen, and marketing agencies). Depending on whether the rules are written and enforceable by law, market institutions could be termed as informal and formal. In an informal institution rules are only implicitly known and they are enforced through social sanctions. Examples of informal institutions are relational transactions, clientelism, transaction through acquaintances and brokerage in rural markets. In a formal market institution, exchange takes place through publicly known rules and exchanges are enforced through formal legal procedures. Examples of this type



are contract farming, cooperative marketing, commodity exchange markets, and organized auctions.

The rationale behind the emergence of market institutions has been a major area of research since the revitalization of institution as a vehicle for economic growth and development (North, 1990, Williamson, 2000). The issue is more prevalent in underdeveloped economies where economic institutions are functionally interconnected with social relations. For instance clientelism in a rural market is meant to establish trust at the same time as securing social insurance in the face of risk. Tenancy contract in land is another example in which land contract is made through kinships. In recent times, three strands of economic thoughts have been developed to explain the emergence of market institutions. The first theory argues that institutions are adaptations to reduce transaction costs (Cheung, 1969, Coase, 1937, Williamson, 1979). The second theory argues that institutions emerge whenever markets fail to reveal the correct price signals due to information asymmetries (Stiglitz, 1986). The third group of economists associates the emergence of institutions with the need for collective actions (Olson, 1965, Ostrom, 2000). The efficient use of common pool resources, for instance, requires cooperation and coordination among resource users. Enhancing bargaining power of smallholders in a commodity market requires collective action in the form of cooperatives.

An equally controversial issue is that whether informal institutions are less efficient than formal institutions in creating incentives and constraints to bring about socially and privately desired goals. While informal institutions are acknowledged for their flexibility to adjust conditions based on observable variables, formal institutions are renowned in protecting opportunistic behavior. However, one cannot be sure that informal institutions result in Pareto optimal outcomes. Depending on the bargaining positions of exchanging parties,

opportunistic behaviors may outweigh the benefits obtained from flexibilities. Besides the rigidity of formal institutions to adjust for unforeseen outcomes, they are vulnerable to moral hazard problems.

### **Research questions and objectives**

Several studies have been conducted to evaluate the performances of Ethiopian commodity market and the impacts of policy changes (Amha and Gabre-Madhin, 2005, Bekele, 2002, Dadi, et al., 1992, Dessalegn, et al., 1998, Gabre-Madhin and Amha, 2005, Gabre-Madhin, 2001, Getnet, 2007, Getnet, et al., 2005, Negassa, 1998, Negassa, et al., 2004). The studies address the spatial spread and transmission of prices, the structure and conduct of markets and the institutional relationship among middlemen immediately after the 1990 reform. However, the following areas of concerns have been inadequately addressed:

- How do market prices behave over time? Do Ethiopian commodity markets characterized by rational price expectation?
- How does speculation affect price dynamics? Does the inter-temporal arbitrage reflect rational or opportunistic behavior? Should speculators be regulated?
- Does imported food aid disrupt the domestic market? If yes, when and where?
- How can producers be protected from disincentives created by imported foods?
- Does economic rationale adequately explain the emergence of informal market institutions?
- How far should we rely on informal institutions for reducing transaction costs and coordinating market behaviors?
- Do emerging formal institutions perform better than informal institutions?

- Why does the growth of agricultural marketed surplus remain low despite the considerable resources pumped to the sector?
- Does the commercialization of smallholders reduce poverty and increase productivity?

These issues are important in explaining the very complex and diverse marketing system whose performance bears not only on business fluctuations but also has important implication on the life of poor producers and consumers.

The purpose of this thesis is to generate timely and scholarly information that may help our understanding about the operation of imperfect commodity markets. Specifically, the thesis is aimed to evaluate the performance of Ethiopian agricultural commodity markets (teff, maize, wheat and bean) in terms of their robustness to internal and external shocks and the efficiency of emerging market institutions (clientelism, contracts and cooperatives). The structure of the thesis is outlined in Figure 4. The thesis is a collection of four self-contained research papers. Each paper addresses a different issue. The papers assess the functioning of market fundamentals and market institutions. The first two papers concentrate on prices as determined by the fundamentals of demand and supply. The theoretical reasoning of these studies follows the neoclassical economics paradigm where the fundamentals are sufficient enough to explain market operations. However, in an imperfect world where transaction is costly, examining the fundamentals is only part of the story. The operations of the markets in terms of coordination, cooperation and competition are assessed on two more studies. The third and fourth papers address the emergence and impacts of market institutions.

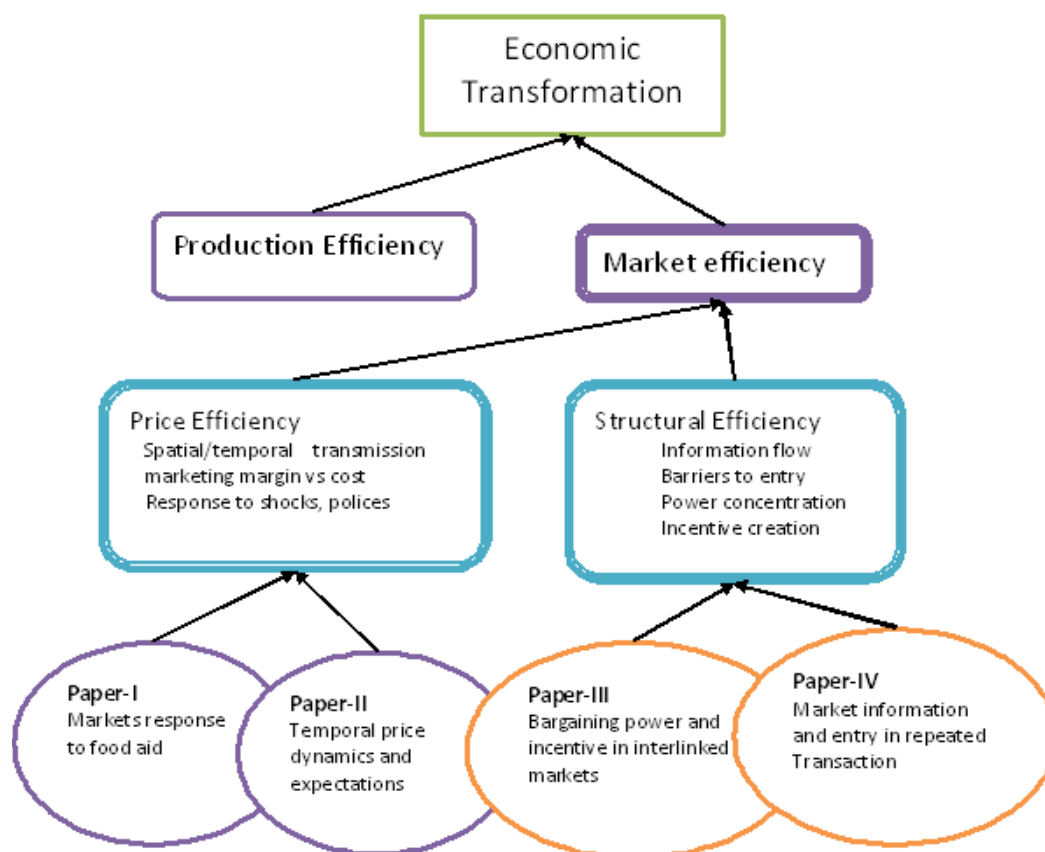


Figure 4. The structure of the thesis

## Summary of findings and recommendations

### *Data and Methods*

The data used in each paper are different and they are obtained from different sources. The first two papers use secondary data collected from government and non-governmental organizations. This data set is of times series observed monthly for several years. The series consists of retail prices from central and regional markets, rainfalls, population and food aid shipments. The third and fourth papers are based on primary household data collected for this thesis work. Two sets of household surveys are conducted in the southern Ethiopia. The

first survey was done in 2006 and is used for paper three. The second survey was in 2009 for the fourth paper. The details of the data are presented in the respective papers.

Following the nature of the data sets, the methods used in each paper are different. For the first two papers, time series econometric methods are employed. The challenge in time series econometrics is the problem of non-stationarity. However, based on several tests, the series were found to be stationary. For the last two papers we use cross-sectional data and hence micro-econometric methods are applied to predict probability of households' participation in a market or market institutions. The major challenge in these studies is the classical problem of endogeneity of impact analysis using household data. Unfortunately, the data could not allow us to apply alternative models of controlling endogeneity. Endogeneity is, thus, tackled by applying two stage parametric regressions using instruments. While two stage switching regression is applied for the third study, the standard IV approach is used for the last study. The summary of the findings are presented below.

#### *The effect of food aid on food prices*

Despite ample studies on food aid disincentive effect on production, a study that specifically examines the empirical links between domestic prices and food aid shipments is very limited. Such information helps to convince policy makers regarding monetization and targeting of food aids. We, thus, assess the effect of imported food aid on traded and non-traded commodity prices to contribute to the ongoing debate on the long term impacts of food aid.

The result reveals that the impacts of food aid on prices vary across commodities but not across regions. Price of non-traded commodity such as teff is not affected by food aid. Both surplus and deficit markets are equally and adversely affected by imported food aid. We also found that food aid up to 10% of the domestic production causes less harm to the market.

Importing food aid during surplus periods depresses the market more than aids during deficit periods. Whenever the share of food aid reaches to two digits, the emergency effort starts to jeopardize the economy in the long term. Food aid targeting should become production-sensitive: to avoid disincentives, food aid should be provided only during periods of true production shortfall.

### *Speculation and the behavior of commodity prices*

The inter-temporal behavior of commodity prices is examined to shed light on the possibility of predicting price expectations and the need for policy intervention to regulate speculators. While many researches were done on the spatial price spreads, the inter-temporal price dynamics of food grains has never be addressed. This is partly because of lack of well established methodology to deal with temporal issues of markets such as speculations, arbitrages etc. We formulated a periodic threshold model and estimated with maximum likelihood approach to study the behavior of food prices in a developing country context.

The result shows that speculation is an important determinant of prices dynamics in Ethiopian food markets. There exists strong structural break related to speculations about future prices. Prices are more volatile when they are high (without speculative storage) than when they are low (with speculative storage). This speculative trade is dictated by rational expectation rather than opportunistic behavior. Traders generate a marginal rate of return close to their stochastic marginal cost. An important contribution of this study is its methodological insights regarding the use of threshold analysis to understand the inter-temporal behavior of commodity prices. It also sheds light on a number of policy relevant issues. Such that the presumption of speculative behavior while price stabilization policies are formulated and implemented. We also confirmed that there is little ground for designing

anti-speculative storage measures. We, rather recommend the government to encourage more competitive inter-temporal private trade through reducing storage costs and formalizing speculative trade.

#### *Interlinked contracts and smallholders' commercialization*

Commercializing smallholders' is considered as an important strategy of increasing smallholder producers. To better understand how smallholders be commercialized, their institutional choice while they are selling their grains is evaluated. The impacts of formal (cooperatives) and informal institutions (relational contracts) on the level of commercialization are compared. We uncover the incentive structure of context specific formal and informal institutions both theoretically and empirically. By doing so, we discover the importance of bargaining power problem in relational contract and uniform pricing in cooperatives that are either overlooked or inadequately touched so far.

The empirical analysis is based on multinomial models and switching regressions. We find that the use of multinomial switching regression for analyzing impacts of multiple institutional innovations provides important empirical insights. The multinomial regressions analysis show that smallholders' market outlet choice (among relational contract, cooperate contract and spot market) appears to depend significantly on risk and information access but not on marketing costs. Those who are risk averse and have better access to information are likely to choose cooperative market. The extent of commercialization is also significantly influenced by bargaining power and non-discretionary pricing. Estimates from multinomial (more than two) switching regressions indicates that relational contract impacts smallholders' commercialization better than cooperatives implying the discretionary effect is stronger than the bargaining power. As a result we suggest revising the ever existed attitude of considering relational contract as exploitation mechanism and discouraging its existence.

There is also a need for reorganizing cooperatives to realize the long awaited goal of commercialization and economic transformation.

#### *Clientelism among farmers and traders*

We examine the role of informal relation between traders and farmers called clientelism in reducing information searching and its long term effect on the competitiveness of agricultural markets. A time-variant repeated game model has been formulated to predict hypotheses for empirical tests. Using the data set collected from rural markets in Ethiopia, the participation of producers in clientelism and its effect on producer prices are estimated.

The result indicates that clientelism in rural grain markets is a rational response to lack of access to well-organized market information and services. When farmers are faced by excessive transaction cost related to on spot information searching and marketing malpractices such as cheating, they opt for repeated transaction with the same buyer to establish trust. Trust established through clientelism has resulted in receiving higher prices. However, this trust will likely jeopardize the long term performance of the market through restricting new market entrants as grain traders. Clientelism is a strong social relationship, which cannot be break up by new entrant, because of the considerable screening cost required to establish it. Whenever, entry is restricted, the long term competitiveness of markets will be jeopardized. From this preliminary observation, we conclude that informal institutions are not perfect substitute of formal institutions. We need to seek effective and efficient market institutions that would provide timely market information and enhance competitiveness as the same time.



### *Overall conclusion*

Since the topics covered in the thesis are so wide, it is very difficult to come up with a single exhaustive conclusion. However, one thing vividly emerged from the individual analysis. That is building markets and market institutions require examinations of alternative sources of incentives and disincentives. Ethiopian grain market is striving to respond for new initiatives and external shocks. In one hand, this is an indication of the revival of the market. On the other hand, this alerts the need to monitor and evaluate the market for corrective actions. Though markets are celebrated for their resource allocation efficiency, in areas where markets are imperfect, there exists always room for welfare-improving policy interventions. The interventions should concentrate on building institutions that are incentive compatible. The challenge in building institution is to sacrifice short-term benefits for the sake of attaining long term objective-economic progress and prosperity.

### **References**

- Amha, W. " Food grain Marketing Development in Ethiopia After the Market Reform 1990: A Case Study of Alaba Siraro District." 1994.
- Amha, W., and E. Gabre-Madhin (2005) Structure and conduct of grain marketing in Ethiopia ed. J. Pender, et al. Addis Ababa, IFPRI.
- Barrett, C. B., and E. Mutambatsere (2005) Agricultural markets in developing countries, ed. L. E. Blume, and S. N. Durlauf, second Edition. London, Palgrave Macmillan.
- Bekele, G. (2002) The Role of the Ethiopian Grain Trade Enterprise in Price Policy, ed. T. Bongor, E. Gabre-Madhin, and S. Babu. Addis Ababa, Ethiopia IFPRI.
- Bernard, T., E. Gabre-Madhin, and A. S. Taffesse (2007) Smallholders' Commercialization through Cooperatives: A Diagnostic for Ethiopia, International Food Policy Research Institute (IFPRI).
- Binswanger, H. P., and M. R. Rosenzweig. "Behavioural and material determinants of production relations in agriculture." *Journal of Development Studies* 2, no. 3(1986): 503-539.

- Cheung, S. N. S. "Transaction Costs, Risk Aversion, and the choice of Contractual Arrangments " *Journal of Law and Economics* 12, no. 1(1969): 23-42.
- Coase, R. "The Nature of the Firm." *Economica* 4(1937): 386-405.
- Dadi, L., A. Negassa, and S. Franzel. "Marketing maize and tef in western Ethiopia: Implications for policies following market liberalization." *Food policy* 17, no. 3(1992): 201-213.
- deJanvry, A., M.Fafchamps, and E. Sadoulet. " Peasant household behaviour with missing markets: some paradoxes explained. ." *Economic Journal* 101(1991): 1400-1417.
- Dessalegn, G., T. S. Jayne, and J. D. Shaffer (1998) Market Structure, Conduct, and Performance: Constraints on Performance of Ethiopian Grain Markets. Addis Ababa, Ministry of Economic Development and Cooperation.
- Devereux, S. "Entitlements, availability and famine: A revisionist view of Wollo, 1972-74." *Food Policy* 13, no. 3(1988): 270-82.
- Fafchamps, M. *Market institutions in Sub-Saharan Africa: Theory and Evidence* London The MIT Press, 2004.
- FAO (2008) The State of Food and Agriculture Rome, FAO.
- Gabre-Madhin, E. (2007) The Ethiopian Commodity Exchange (ECEX):Making the market work for all.
- Gabre-Madhin, E., and W. Amha (2005) Characterizing Grain Traders. Addis Ababa, Ethiopia
- Gabre-Madhin, E. Z. (2001) Market Institutions, Transaction Costs, and Social Capital in the Ethiopian Grain Market. WASHINGTON, D.C., IFPRI
- Getnet, K. "Spatial Equilibrium of Wheat Markets in Ethiopia." *African Development Review* 19, no. 2(2007): 281-303.
- Getnet, K., W. Verbeke, and J. Viaene. "Modeling spatial price transmission in the grain markets of Ethiopia with an application of ARDL approach to white teff " *Agricultural Economics* 33(2005): 491-502.
- Hassan, S. (2009) The Dangerous hype behind Ethiopian commodity exchange  
<http://www.ethiopianreview.com/content/10425>
- Holden, S., B. Shiferaw, and J. Pender. " Market imperfections and land productivity in the Ethiopian Highlands." *Journal of Agricultural Economics* 52, no. 3(2001): 53-70.
- Islam, N., and S. Thomas. *Foodgrain Price Stabilization in Developing Countries* Food Policy Review 3. Washington, D.c: IFPRI, 1996.

- Loening, J. L., D. Durevall, and Y. A. Birru (2008) *Inflation Dynamics and Food Prices in an Agricultural Economy: The Case of Ethiopia*.
- Mezlekia, W. (2009) What's wrong with Ethiopia's commodity exchange  
<http://www.ethioplanet.com/news/2009/09/21/>
- MoARD (2006) *Report on Price Stabilization Strategies*. Addis Ababa, Ministry of Agriculture and Rural Development, Ethiopia
- Negassa, A (1998). *Vertical and Spatial Integration of Grain Markets in Ethiopia: Implication for Grain Market and Food Security Policies* Addis Ababa Ministry of Economic Development and Cooperation, Ethiopia.
- Negassa, A., R. Myers, and E. Gabre-Madhin (2004) *Grain Marketing Policy Changes and Spatial Efficiency of Maize and Wheat Markets in Ethiopia* Washington, D.C, International Food Policy Research Institute.
- Newbery, D. M. G., and J. E. Stieglitz. *The Theory of Commodity Price Stabilization: A Study in the Economics of Risk*. New York: : Oxford University Press, 1981.
- North, D. C. *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press, 1990.
- Olson, M. *The Logic of Collective Action: Public Goods and the Theory of Groups* Cambridge: Harvard University Press, 1965.
- Ostrom, E. " Collective Action and the Evolution of Social Norms." *Journal of Economic Perspectives* 14, no. Summer(2000): 137-158.
- Pingali, P. L. "From Subsistence to Commercial Production Systems: The Transformation of Asian Agriculture." *American Journal of Agricultural Economics* 79, no. 2(1997): 628-634.
- Rashid, S., et al. (2008) *The Ethiopia Cereal Availability Study 2008. The Descriptive Report*, IFPRI, EDRI, and EIAR, Addis Ababa
- Sadoulet, E., and A. deJanvry. *Quantitative Development Policy Analysis* The Johns Hopkins University Press 1995.
- Sadoulet, E., and A. d. Janvry. *Quantitative Development policy Analysis: : The Johns Hopkins university press*, 1995.
- Sahn, D. E., and C. Delgado (1989) *The Nature and Implications for Market Interventions of Seasonal Food Price Variability* ed. D. Sahn. Baltimore, Johns Hopkins University Press.

- Singh, I., et al. *Agricultural household models : extensions, applications, and policy*. Baltimore: Johns Hopkins University Press, 1986.
- Stiglitz, J. E. "The New Development Economics " *World Development* 14, no. 2(1986): 257-265.
- Thompson, R. L. (2007) *Challenges Facing the Food & Agricultural Sector*, ed. A. Testa, and C. S. Pierre. Stratford-Upon-Avon, England, International Food and Agricultural Trade Policy Council (IPC).
- Timmer, C. P. "Farmers and Markets: The Political Economy of New Paradigms." *American Journal of Agricultural Economics* 79, no. 2(1997): 621-627.
- Ulimwengu, J. M., S. Workneh, and Z. Paulo (2009) *Impact of Soaring Food Price in Ethiopia: Does Location Matter?*, IFPRI.
- von-Braun, J., et al. (2008) *High Food Prices: The What, Who, and How of Proposed Policy Actions*. *Policy Brief*. Washington, DC, International Food Policy Research.
- WDR (2008) *World Development Report 2008: Agriculture for Development*, ed. W. Bank.
- Williams, J. C., and B. D. Wright. *Storage and Commodity Markets*: Cambridge Cambridge University Press, 1991.
- Williamson, O. E. " The New Institutional Economics: Taking Stock, Looking Ahead." *Journal of Economic Literature* 38, no. 595-613(2000).
- Williamson, O. E. "Transaction-Cost Economics: The Governance of Contractual Relations " *Journal of Law and Economics* 22, no. 2(1979): 233-261.
- Wodon, Q and H. Zaman. " Higher Food Prices in Sub-Saharan Africa: Poverty Impact and Policy Responses". *World Bank Res Obs* 2010 25: 157-176; doi:10.1093/wbro/lkp018

# Paper I



# FOOD AID, FOOD PRICES, AND PRODUCER DISINCENTIVES IN ETHIOPIA

GETAW TADESSE AND GERALD SHIVELY

Although the short-term aims of food aid are well conceived, strong concerns have been voiced regarding the long-term impacts of such aid on incentives for agricultural producers in recipient countries. This article examines the statistical link between food aid shipments and food prices in Ethiopia over the period 1996–2006. Monthly data from three markets and three commodities are used to estimate a system of seemingly unrelated regression models for food prices. Results indicate that previous year food aid shipments reduce prices in all producer and consumer markets. These effects, however, appear to be limited to the set of internationally traded commodities that are domestically marketed. A recursive regression procedure is used to identify the food aid threshold at which a negative aid effect emerges. Food aid shipments that constitute less than 10% of domestic production appear to be benign, but shipments above this level show signs of being disruptive to local markets. We use a simple policy simulation to argue that production-sensitive targeting, e.g., conditioning food aid on local food production, would help to circumvent disincentive effects.

*Key words:* Ethiopia, price analysis, food policy, food aid.

Food aid is widely regarded as a “necessary evil”: necessary to avert hunger in places where household food security has been compromised, but evil because it is suspected of undermining incentives for local production, thereby creating structural dependency on food aid.<sup>1</sup> Nowhere is this dilemma more acute than in Ethiopia, where food aid accounted for 9% of the country’s cereal budget over the period 1994–2006. Although this share is among the highest in the world, in years with particularly poor harvests the proportion of food aid in Ethiopia’s cereal budget has been even larger—as much as 16% in 2003. Moreover, this simple indicator of the importance of food aid masks striking extremes: in food-deficit regions of the country roughly three-quarters of rural households receive food assistance during drought years, providing more than

one-third of their calorie consumption (Little 2006). In the most recent period (2004–2006), Ethiopia’s levels of agricultural production exceeded its historic average. Nevertheless, aid shipments remained substantial, at 4–7% of total consumption. This pattern underscores ongoing concerns regarding Ethiopia’s structural dependence on food aid.<sup>2</sup>

The idea that food aid shipments might exert a pernicious effect on incentives for local production remains controversial, in academic and policy circles alike. At least since Schultz (1960) many observers have argued that food aid unambiguously undermines incentives for domestic food production and that withdrawing such aid will increase household welfare in the long run by stimulating domestic production (Gelan 2007). In contrast, those in a second group, among them Abdulai, Barrett, and Hoddinott (2005), Bezuneh, Deaton, and Zuhair (2003), and Levinsohn and McMillan (2005), argue that empirical support for the hypothesis that food aid creates disincentives for recipient country farmers is substantially weakened once one accounts for the endogeneity of food aid to local production. To

---

Getaw Tadesse is a graduate student at Department of Economics and Resource Management, Norwegian University of Life Sciences, Norway, and Gerald Shively is professor at Department of Agricultural Economics, Purdue University, Indiana.

Authors acknowledge the constructive advice of two anonymous reviewers and the editor, Jeff Dorfman. Helpful suggestions were also provided by Atle Guttormsen, Manish Gupte, and Will Masters. This research was made possible, in part, through support provided by the Norwegian University of Life Sciences and the Bureau of Economic Growth, Agriculture and Trade, U.S. Agency for International Development through the BASIS Assets and Market Access Collaborative Research Support Program. The opinions expressed herein are those of the authors and do not necessarily reflect the views of the sponsoring agency.

<sup>1</sup> See, for example, the 2004 comments of the Ugandan member of the Food Trade and Nutrition coalition, as quoted by the Wemos Foundation (2005).

---

<sup>2</sup> Food aid can take the form of program, project, or emergency/humanitarian assistance. For a discussion of these types of aid and their uses, see Barrett (2001). Of the total amount of food shipped to Ethiopia, emergency assistance accounts for the largest share (65%), followed by program aid (23%), and development assistance (12%).

some extent these contradictory conclusions emanate from differences in methods and assumptions. However, nearly all studies share one important premise, namely that international food aid unconditionally depresses local food prices and that the effect is almost always harmful to producers. The main contribution of this article is to provide a more nuanced understanding of this stylized fact. In particular, we demonstrate empirically that, even in an economy where markets are well integrated and food aid effects are transmitted widely to surplus and deficit regions, discernable disincentive effects may not extend beyond those internationally traded commodities that are domestically marketed. Moreover, producer disincentives seem more likely to arise when the proportion of food aid in total food supply exceeds a critical threshold.

Several arguments inform our investigation. First, in Ethiopia, where the nontradable staple “teff” is by far the major production and consumption grain, the effect of food aid on the price of teff (and subsequently on incentives for its production) depends critically on the degree to which imported food can substitute for teff in people’s diets (Webb, Von Braun, and Yohannes 1992). Second, considerations of spatial transmission and spillover apply (Devereux 1988). For example, food aid effects may be most pronounced in regions that are affected by shortfall or in regions for which local supply is intermittent and a “price ripple” hypothesis may mandate the need for food aid in periods of shortfall. Third, potential disincentive effects cannot be examined outside the context of such domestic shortfalls and windfalls. Food aid is well known to be inefficiently targeted (Clay, Molla, and Habtewold 1999; Jayne, Strauss, Yamano, and Molla 2001), and the weak correlation between production levels and food aid imports may influence the overall effect of food aid on local prices. For example, where local production is strongly influenced by natural shocks but food aid is continuous across time, producers may see food aid as a disincentive to production. Additionally, while net sellers may suffer from lower prices, lower prices resulting from food aid help net buyers (Levinsohn and McMillan 2005), thereby averting famine and maintaining demand in the long run. The net effect, therefore, can depend on the magnitude of food aid relative to domestic supply, since this helps to determine the relative contributions of aid to maintaining demand and discouraging supply. A fourth factor at play is a potential weakening of producer disincentives

if food aid is provided only to the poorest of the poor. These individuals may not fully participate in the market either as buyers or sellers. As a result, to the extent food aid targeting is efficient and repackaging and reselling of food aid is not widespread, the effect of food aid on prices, as transmitted through the market participation of the ultra-poor, may be small.<sup>3</sup>

Given these many empirical uncertainties, it is unfortunate that little research investigates the possible and actual effects of food aid on local food prices. Most studies have been conducted at either a household or a macro-level. Tschirley, Donovan, and Weber (1996) are among the few that examine market level effects, assessing the impacts of program food aid and emergency transfers on food prices in Mozambique. One unfortunate shortcoming of that study, however, is that the researchers rely on data from a period in which food prices were strongly influenced by the government, so that market outcomes arising from food aid shipments cannot be easily discerned. In addition, the authors employ simulations based on structural equations, which may not accurately reflect market movements. Actual markets are characterized by considerable heterogeneity across commodities and geographical locations, both of which can introduce complexities that might be missed by a simulation approach. Variability of conditions and food aid shipment over time could also introduce considerable heterogeneity in market response.

To improve our understanding of the effects of food aid on local markets, in this article we seek to move the literature forward in three ways. One, we provide comprehensive empirical evidence on the price effects of food aid for Ethiopia, looking across a range of markets and commodities. Two, we identify the level of food aid that begins to trigger a price collapse and disincentive effect for producers. And three, we demonstrate how policy makers could minimize disincentive effects by conditioning food aid on levels of domestic production. We introduce as our conceptual foundation a partial equilibrium model of food aid introductions into a commodity market. Our empirical approach relies on a series of seemingly unrelated and recursive regressions. Using monthly data from three geographic markets and three commodities in Ethiopia over the period 1994–2006, we find

---

<sup>3</sup> Elliesen (2002) has estimated that approximately 30% of total food aid distributed in Ethiopia is repackaged for sale in local markets.



a substantial negative food aid effect on local food prices. Furthermore, we demonstrate that, due to strong market integration, these food aid effects are transmitted widely. The result, we argue, is that producers in surplus and deficit regions are affected somewhat equally. However, our evidence also suggests that the measured disincentive effects do not extend to nontradable commodities and are sensitive to a threshold, reflecting the overall proportion of food aid in the total cereal supply.

## Framework

From the perspective of food producers in a recipient country, food aid can impact local production in three distinct ways: (a) by providing a safety net for producer-consumers; (b) via an overall development effect; and (c) by depressing local prices. The safety net effect is beneficial to producer-consumers: by making food available to the poor during crises, food aid can maintain productive capacity by reducing asset liquidation that might otherwise occur in its absence (Barrett 2001; Bezuneh and Deaton 1997). Similarly, food aid distributed as part of development assistance, such as through food-for-work (FFW) programs, can also help to develop public goods, including those that improve the long-run prospects for agricultural production.<sup>4</sup> In contrast, the adverse impact of food aid on local production occurs primarily by depressing prices and creating a “dependency syndrome,” in which regular flows of food aid over time, coupled with recurrent production failures, cause food beneficiaries to become reliant on food aid. Reduced motivation to self-provision means potential producers, including those that might become net sellers, tend to allocate fewer resources to production and disregard strategies such as saving during surplus periods (Elliesen 2002; Lentz, Barrett, and Hoddinott 2005).

The net effect of food aid shipments on local food prices, therefore, depends on the relative importance of these three effects, as well as the relative potential for storage of local grain and imported food (Gabre-Madhin 2001).<sup>5</sup> The

factors governing these effects include structural features of the food economy and the policy environment, including the overall integration of markets, the degree to which imported foods can be substituted for local foods, and the relative efficiency with which aid is targeted to beneficiaries in space and time. Geographically dispersed markets may respond differently to food aid depending on their production potential and susceptibility to production shocks. Responses may also vary across commodities depending on tradability and the elasticity of substitution among domestic and imported foods. In fact, it is likely that price responses will differ in food-deficit and food-surplus periods, irrespective of local market characteristics.

To further tease out the conceptual linkages between food aid and market prices, we use a simple partial equilibrium model.<sup>6</sup> Consider a competitive market in which price is determined through the interplay of supply and demand without government intervention. Let  $Q$  represent domestic production,  $A$  represent aid shipments,  $P$  represent the market-clearing price, and  $Y$  represent income. The domestic supply function for  $Q$  is expressed as follows:

$$(1) \quad S = f(P, R)$$

where  $R$  is a vector of supply shifters such as rainfall or the prices of inputs. Demand is

$$(2) \quad D = g(P, Y, A).$$

We assume the quantity of food aid affects domestic demand through substitution.

If the majority of food consumers and producers are farm households who rely on own production as well as market purchases, equations (1) and (2) can be seen as arising (albeit approximately) from the aggregation of a series of nonseparable household models (Fafchamps 2004; Singh, Squire, and Strauss 1986). The practical implication is that income is endogenous to production. Price changes

<sup>4</sup> Clearly, however, ill-conceived FFW programs may distort the labor market and crowd out private investment (Bezu and Holden 2008; Holden, Barrett, and Hagos 2006).

<sup>5</sup> The best analysis of grain storage in Ethiopia remains the study by Gabre-Madhin (2001), who documents Ethiopia's relatively weak storage infrastructure and the very low levels of capacity and rates of utilization by private traders. For example, of the more than 2,000 warehouses built by Ethiopia's Agricultural Marketing Corporation prior to the 1990 market reforms, utilization rates in 1992 were less than 50% and their overall value in providing

a buffer stock during the study period appears to have been low. Unfortunately, we lack sufficient data to incorporate storage in our analysis. In the case of food aid, our view is that long-term storage is minimal, as most landed food aid is targeted for immediate distribution and consumption. In the case of domestic storage by households, traders, and the government, we expect storage effects to be captured by our use of lagged prices. Accordingly, our interpretation of this variable reflects this possibility.

<sup>6</sup> Using a general equilibrium model, Gelan (2007) finds in a simulation based on Ethiopian data that food aid has unambiguous disincentive effects on domestic food production and that the removal of food aid leads to a modest increase in food prices and domestic food production.

lead not only to income and substitution effects but also to a profit effect. As a result we express the income function as

$$(3) \quad Y = h(P, A, E)$$

where  $E$  represents the vector of prices associated with other income sources such as wage employment and nonagricultural enterprises. We totally differentiate equations (1)–(3) and express the results in terms of the product of changes. These are as follows:

$$(1') \quad d\ln S = \mu_1 d\ln P + \mu_2 d\ln R$$

$$(2') \quad d\ln D = \eta_1 d\ln P + \eta_2 d\ln Y + \eta_3 d\ln A$$

$$(3') \quad d\ln Y = \gamma_1 d\ln P + \gamma_2 d\ln A + \gamma_3 d\ln E$$

where  $\mu_1 > 0$ ,  $\mu_2 > 0$  are supply elasticities with respect to price and rainfall;  $\eta_1 < 0$ ,  $\eta_2 > 0$ , and  $\eta_3 < 0$  are demand elasticities with respect to price, income, and food aid; and  $\gamma_1 > 0$ ,  $\gamma_2 > 0$ , and  $\gamma_3 > 0$  are income elasticities with respect to the food price, food aid, and other income sources.

Equilibrium in this market is maintained when the rate of growth in total demand is equal to the proportional rates of growth in domestic and international food supplies:

$$(4) \quad d\ln D = (1 - \theta)d\ln S + \theta d\ln A$$

where  $\theta$  is the share of food aid in total consumption. The equilibrium price is a function of food aid and other factors. Using the above equations and an equilibrium condition, we can solve for the relationship between rates of change in food aid and rates of change in the equilibrium price (see Tadesse and Shively, 2009):

$$(5) \quad \frac{\partial P'}{\partial A'} = \frac{\eta_2 \gamma_2 - \theta + \eta_3}{(1 - \theta)\mu_1 - \eta_1 - \eta_2 \gamma_1}.$$

Equation (5) indicates that the sign of a food aid effect, if any, is indeterminate unless additional restrictions are placed on the model. A useful intuition regarding equation (5) comes from interpreting the denominator of the right-hand side as the long-term effect of food aid on the local price and the numerator as the short-term effect of food aid on the local price.<sup>7</sup> In

<sup>7</sup> This interpretation reflects the fact that the numerator is derived by differentiating each equation in the system (1–4) with respect to food aid, which approximates the immediate effect of food aid on price. The denominator is derived by differentiating the

the short-term, food aid affects the market in three ways: through income, share, and substitution effects. The income effect,  $\eta_2 \gamma_1$ , shifts demand upward and unambiguously increases price. The share effect implies that, as the rate of change in food aid increases by one unit, the rate of change in total supply changes by the amount  $\theta$ . As a result, the supply curve shifts upward, subsequently reducing the equilibrium price. The substitution effect,  $\eta_3$ , is negative if the commodity is a close substitute for the imported food. In sum, the total effect of a food aid shipment depends on the magnitudes of these combined effects. Since the income effect is likely to be relatively small in a food aid setting, one might reasonably expect an overall negative short-term impact. If the commodity is not a close substitute, however, then food aid will have either a positive or negligible effect on price changes. The long-term effect is observable if the market adjusts for food aid shocks after some time. If the local price responds to food aid, then demand, supply, and income can potentially change.<sup>8</sup> The consumption effect is always negative, and the supply and income effects are positive. Thus, a price reduction leads to an increase in consumption and a decrease in production and income.

The net overall effect (combining short-run and long-run impacts) depends on a number of factors. Given an empirically plausible range of values for the elasticities, the effect appears to hinge on the magnitude of the share of food aid on the total food supply. A close investigation of equation (5) indicates that the food aid share has a nonlinear effect on the marginal impacts of food aid on food prices. With small food aid shares, the marginal effect of food aid shipments could be positive, while with relatively larger shares, the marginal effect of food aid shipments could be negative. The exact outcome at a place and time, of course, is an empirical matter.<sup>9</sup>

system with respect to price, following the entry of food aid to the market. Our view is that when food aid enters the local market, it first affects market demand leading to a price change. Subsequent to this, any change in price influences supply, generating a second-round of price effects. The former is a short-term change driven by the demand side. The latter is a longer-term effect from the supply side.

<sup>8</sup> The income effect arises from producer-consumers (see Sadoulet and de Janvry 1995).

<sup>9</sup> For example, evaluating equation (5) using plausible elasticity values of  $\eta_1 = -0.7$ ,  $\eta_2 = 0.8$ ,  $\eta_3 = -0.7$  and  $\gamma_1 = \gamma_2 = \gamma_3 = 1.0$  leads one to conclude that prices will be largely unchanged when food aid is either a small or a very large proportion of overall supply. With a low food aid share, local demand dominates any external addition to supply. With a high food aid share, external supplies

**Table 1. Regression Results for Food Aid Effects on Food Prices, by Region and Commodity**

Regressors	Markos	Dessie	Addis Ababa	Wald Test ( $\chi^2$ )
<b>Maize</b>				
$A_t$	4.29** (2.14)	6.16*** (2.79)	2.8* (1.89)	
$A_{t-1}$	-3.45* (1.84)	-4.70** (2.31)	-2.37* (1.69)	
$R^2$	0.80	0.68	0.83	7.67*
$D-W$	1.99 (0.01)	2.04 (0.02)	2.03 (0.02)	
<b>Wheat</b>				
$A_t$	4.40** (2.00)	1.54 (0.71)	1.92 (1.20)	
$A_{t-1}$	-5.08** (2.39)	-3.99* (1.86)	-4.47*** (2.83)	13.32***
$R^2$	0.83	0.80	0.88	
$D-W$	2.12 (0.06)	2.068 (0.03)	2.14 (0.07)	
<b>Teff</b>				
$A_t$	2.47 (1.28)	1.84 (0.91)	0.27 (0.16)	
$A_{t-1}$	-3.81** (2.01)	-2.52 (1.28)	-2.17 (1.26)	5.4
$R^2$	0.84	0.77	0.78	
$D-W$	2.05 (0.03)	1.97 (0.02)	2.03 (0.02)	
Wald test ( $\chi^2$ )	9.20**	7.73*	8.83**	

Note: Absolute z-values presented in parentheses. Other regressors included in the models include lagged prices, rainfall, population, and monthly dummies. To simplify presentation, coefficient estimates are not presented here but are available in Tadesse and Shively (2009). The numbers in parentheses following the Durbin-Watson  $d$ -statistics are first-order autocorrelation coefficients estimated using the Durbin-Watson method. The Wald tests are for the null hypothesis that the effect of food aid is zero across markets or commodities under examination.  $D-W$  = Durbin-Watson. Single, double, and triple asterisks represent statistical significance at the 10%, 5%, and 1% levels.

**Econometric Strategy**

We begin our empirical analysis by focusing on a reduced form of equation (4), which we estimate using seemingly unrelated regression (SUR) for three commodities and three markets. SUR is chosen in order to control for the contemporaneous correlation of unobserved shocks across commodities and markets. This approach allows shocks to be idiosyncratic or covariate among markets.

The vector representation of our SUR system is as follows:

$$(6) \quad \mathbf{P}_t = \boldsymbol{\alpha}_0 + \mathbf{P}_{t-k}\boldsymbol{\beta} + \mathbf{A}_{t-i}\boldsymbol{\lambda} + \boldsymbol{\delta}\mathbf{X}_t + \boldsymbol{\varepsilon}_t$$

where  $\mathbf{P}$  denotes an  $n \times 1$  vector of prices,  $n = c \times m$ ;  $c$  is the number of commodities;  $m$  is the number of markets;  $\boldsymbol{\beta}$  is an  $n \times k$  matrix of autoregression coefficients for the prices of  $j = 1, 2, 3, \dots, c$  commodities;  $k$  is the lag length;  $\mathbf{A}$  is an  $n \times q$  matrix of food aid for  $i = 0, \dots, q$  commodities; and  $\mathbf{X}_t$  is a time-indexed vector of exogenous demand and supply shifters such as population, rainfall, and seasonal dummies.

dominate local supply and the structure of the market changes markedly. At intermediate shares, however, as the share of food aid increases the marginal effect of that share on the price changes from positive to negative and the magnitude of the marginal effect rises.

The  $n \times 1$  vector  $\boldsymbol{\varepsilon}_t$  is a vector generalization of white noise, that is,

$$(7) \quad E(\boldsymbol{\varepsilon}_t) = 0 \quad \text{and} \\ E(\boldsymbol{\varepsilon}_t\boldsymbol{\varepsilon}_\tau) = \begin{cases} \boldsymbol{\Omega} & \text{for } t = \tau \\ 0 & \text{otherwise} \end{cases}$$

Our major interest rests with the signs, magnitudes, and statistical significance of the elements of  $\boldsymbol{\lambda}$ , an  $n \times q$  matrix consisting of the marginal impacts of food aid on contemporaneous prices.

Consistent and efficient estimates of the parameters of equation (6) are obtained using iterated feasible generalized least squares (IFGLS), which is equivalent to maximum likelihood estimation. Efficiency in IFGLS requires stationarity and the absence of uncorrected autocorrelation. We test for unit roots in observed prices using a series of Dickey-Fuller tests. Reassuringly, we find seven out of nine real price series to pass a stationarity test,<sup>10</sup> and the Durbin-Watson  $d$ -test reveals that, except for two equations, no autocorrelation is implied (see table 1). The two remaining

<sup>10</sup> For the two remaining series, wheat in Addis and teff in Markos, test results are weak.

equations display small (below 0.1) negative autocorrelation.<sup>11</sup>

To examine the importance of the magnitude of the food aid share, we use a recursive regression procedure, along the lines Tsay (1989, 1991) suggests in order to maintain linearity in the model while checking for nonlinear response to a change in a variable's level. In essence the standard SUR is extended by recursively estimating many separate SURs, which differ only with respect to the set of observations included, based on the size of the food aid share. We apply the procedure in the context of a system of regressions, estimating the system of equations at each step. The data are sorted in ascending order based on the food aid share, which serves as a threshold. We then sweep across the available observations, estimating equation (6) repeatedly for a window of fixed width. The width of the window refers to the number of observations included in each run. We start with the lower 50% of the sample and proceed by dropping one observation from the sample at the lower limit and adding one observation to the sample from the upper limit, continuing until all observations are exhausted. We collect and compare estimates of marginal effects and standard errors to examine the statistical importance of the assumed threshold. In this way we assemble a picture of the relative importance of the food aid share in dampening local prices.

### Data and Study Area

Our empirical work is based on a data set assembled for current purposes. We choose three spatially separated markets to measure food aid effects across regions with different production potentials. The three markets are Addis Ababa, Debre-Markos (hereafter referred to as Markos), and Dessie. These represent the central market, a food-surplus region and a food-deficit region, respectively. Markos is located in the northwest of the country and is a major supplier of staple grains to the central market and food-deficit regions. Dessie, located to the northeast of Addis Ababa, is a drought-prone area that is a regular recipient of food aid.

<sup>11</sup> The negative autocorrelation in price dynamics is unexpected and may be caused by data interpolation rather than systematic association of disturbances over time. As Gujarati (2003) argues, whenever the autocorrelation coefficient is very small and the problem is not caused by systematic error, the inefficiency loss of autocorrelation may be minor.

To capture substitution effects, if any, among crops, we include three major cereals: teff, wheat, and maize. These commodities vary in terms of tradability/marketability and substitutability to imported food aid. Teff is a non-traded indigenous crop; imported cereals are widely considered to be a poor substitute for teff, and vice versa.<sup>12</sup> Wheat and maize, in contrast, are close substitutes and tend to serve as staples of the poor, who are likely to be targeted for food aid disbursements. Wheat and maize are widely marketed domestically.

We employ four main sets of variables in the estimations: prices, food aid, rainfall, and population. Monthly retail prices, measured in Ethiopian Birr (ETB) per kilogram come from the Ethiopian Central Statistical Agency (CSA) monthly retail price reports (June 1996 to December 2006).<sup>13</sup> Nominal prices are deflated using the CSA national consumer price index. We include in each regression two lagged own prices for each commodity at each market.<sup>14</sup> We do not include prices for other commodities or markets so that the regressions allow for possible contemporaneous transmission of a food aid effect across markets and commodities.

Our measure of food aid is based on annual World Food Program (WFP) food aid shipments, as reported by the FAO. This serves as a proxy for annual food aid supply to local markets. This series covers the period 1994 to 2004. In addition, we include data for 2005 and 2006 shipments from the WFP annual bulletin reports at Addis Ababa. Imported food aid differs in kind. We include the quantity of cereals imported to the country in metric tons of grain and flour combined. The regressions include annual per capita food aid for the current year,  $\mathbf{A}_t$ , and the immediately prior year,  $\mathbf{A}_{t-1}$ . We do not divide this measure by the number of months. Lagged food aid is included to capture the possible role of storage as well as residual effects and institutional and unintentional delays in food distribution to beneficiaries. In many cases, food aid shipments are delayed in distribution and therefore may have gradual or delayed impacts on the market. Since food aid

<sup>12</sup> As a reviewer points out, whether teff and imported cereals serve as substitutes and to what degree they might serve as substitutes during periods of shortfall are important issues that may help to define the periods in which food aid is necessary and has merit. We are not aware of empirical estimates of period-specific elasticities of substitution between teff and other grains, but this seems like a promising avenue for researchers.

<sup>13</sup> In 2006, US\$1 = 8.69 ETB.

<sup>14</sup> The lag length is determined based on the Akaike's information criterion (AIC).

data are reported at the national level, the food aid variables are constant across commodities and markets at each time step. Although we acknowledge that it would be preferable to employ monthly indicators of food aid shipments in our analysis, necessary data that could be used to construct such a series are not available. Admittedly, the use of annual food aid measures and monthly food prices raises the possibility that our regressions could be contaminated by the attempt to correlate a late-year food aid shipment with food prices realized in prior months. While such a scenario cannot be ruled out, it is important to recognize that about 80% of WFP food aid enters Ethiopia via the Djibouti port, from whence it is transported and distributed to warehouses in Ethiopia. The current capacity of the WFP supply chain is approximately 90,000 metric tons per month, which has been estimated to equal eighteen days of total handling capacity at the port (Heigh and Dumoulin 2008). This suggests that it is extremely unlikely that our measures of annual shipments could be dominated by late-year arrivals, since the maximum amount of food aid that could be received and distributed in a single month is slightly less than two months' worth of landed shipments. Instead, we believe the annual food aid shipment is likely to be a reasonable proxy for the monthly values occurring in any given year. However, to minimize any potential unobserved effect of endogeneity bias in our model, we include binary month indicators in our regression dummy variables. If food aid shipments follow regular monthly patterns, this approach should be an adequate correction, although we acknowledge that this treatment would be insufficient to preclude endogeneity in the case of specific idiosyncratic monthly anomalies in food aid shipments.

We include monthly rainfall (in mm) at each market as a regressor to control for domestic production shocks. These data come from the National Meteorological Agency of Ethiopia. We include both the contemporaneous monthly total rainfall of the current year and that of the previous year. Rainfall realizations are specific to markets but uniform across commodities within a market. We generally expect to find a negative relationship between rainfall and prices.

Finally, we include the annual population, in thousands, to capture demand-side shocks, if any. The data comes from the Ethiopian CSA. Current population is used in all regression equations. Under normal circumstances, one

would expect a positive correlation between population size and price.

It is important to reiterate that, because prices are observed monthly but food aid is observed only annually, we expect the presence of unobserved month-specific heterogeneity that may not be captured by our food aid variable. Depending on the nature of this month-specific heterogeneity, either the explanatory variables will be correlated with the error term, the monthly error terms will be serially correlated across years, or both. This problem is analogous to that which arises in a panel data setting; here months represent individual units and years represent time steps. An immediate solution is to include month dummies to control for any unobserved heterogeneity (Wooldridge 2002). We therefore include eleven month-specific dummy variables in each regression. In the interest of space, however, the estimated coefficients for these variables are suppressed from the reported regression results.

Endogeneity of contemporaneous food aid to current prices and the previous-period rainfall could be suspected in the models specified above. If food aid is endogenous to price formation, food aid will be correlated with the error term in our regressions and produce parameters that are inconsistent and inefficient. This endogeneity could emanate from two sources. The first is if food aid shipments are motivated by price hikes rather than production failures. Given the historical behavior of aid agencies and the government, we believe this is highly unlikely for Ethiopia.<sup>15</sup> The second is if food aid and food prices are linked through causal correlations with a common factor, such as production failure. This seems more likely since, for example, a decline in supply could be expected to trigger both a rise in prices and a food aid response. The natural statistical response is to include supply side factors in our price equation. Accordingly, by including rainfall as a regressor we expect any remaining endogeneity of food aid with local prices to be extremely weak. As evidence of the soundness of our approach, we rely on a Hausman test, which recommends that we confidently reject the hypothesis of endogeneity. We recognize, of course, that food aid and

<sup>15</sup> All records and experiences in Ethiopia suggest that, historically, imports of free food aid have occurred in response to supply crises rather than price hikes. The exception is a series of ongoing imports that began in late 2006, which have been justified as famine relief in response to steep price rises. This episode is not included in our data set.

**Table 2. Descriptive Statistics for Prices, Food Aid, and Rainfall in Ethiopia, 1996–2006**

Variable	Mean	Standard Deviation	Min	Max
Maize price at Markos	992.90	251.21	447.15	1765.87
Maize price at Dessie	1195.26	217.26	741.53	1700.20
Maize price at Addis	1187.25	199.51	727.08	1610.32
Wheat price at Markos	1316.41	304.51	635.59	2032.14
Wheat price at Dessie	1853.18	280.61	1120.20	2616.91
Wheat price at Addis	1860.00	262.29	1296.10	2392.09
Teff price at Markos	1733.72	287.93	1145.28	2620.19
Teff price at Dessie	2132.34	245.39	1633.09	2885.21
Teff price at Addis	2630.13	217.78	2258.86	3077.62
Food aid	10.54	5.35	2.13	18.88
Food aid as proportion of total	0.08	0.05	0.01	0.15
Rainfall at Markos	116.20	113.97	0.00	365.20
Rainfall at Dessie	86.48	102.50	0.00	480.20
Rainfall at Addis	89.99	93.79	0.00	346.30

rainfall may be correlated. However, our view is that this correlation reflects not endogeneity, but rather collinearity. As a result, one could possibly fault the parameter estimates as being less efficient than one might desire, but we believe they are consistent and robust, nevertheless.

## Results and Discussion

Table 2 presents descriptive statistics for prices and explanatory variables including food aid shipments. Prices at Markos are much lower, on average, than at other markets, as shown in figure 1. This pattern reinforces our choice of Markos as a producer market. Moreover, the coefficient of variation indicates prices are more volatile in Markos than in consumer markets. The per capita amount of imported free food ranges from 2 to 19 kg per year over the sample period, with the largest amounts occurring in the drought years 2000 and 2003. On average, an Ethiopian receives 10 kg of cereals every year. This accounts for 8% of the sector's total supply, on average. As expected, monthly rainfall is highly variable and the coefficient of variation exceeds 100% at Dessie and Addis Ababa. The highest maximum rainfall is recorded at Dessie, but this area also has the least even rainfall distribution, which points to vagaries in production potential. This underscores our choice of Dessie as a deficit market.

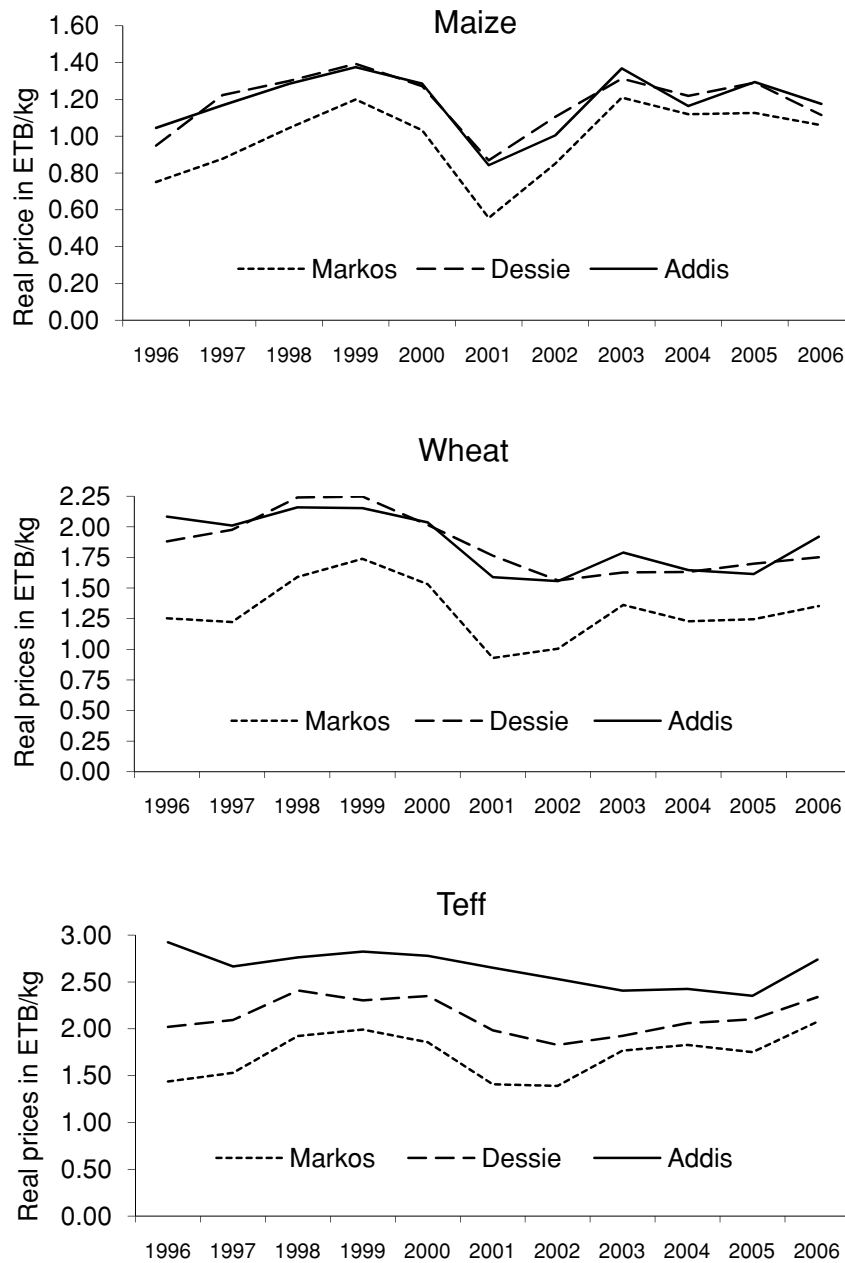
As the data in figure 2 illustrate, we observe a loose correlation between production and food aid during the sample period. Domestic production oscillates between 100 and 160 kg per person. Of the three major famines

during the sample period, which occurred in 1999, 2000, and 2003, the 2000 food deficit was characterized by low production and low prices, suggesting the possibility of a recessionary food crisis. We also observe that, despite the severe food deficit in 2003, the food aid shipment was actually highest in 2002. An optimistic view is that this may indicate an improvement in early warning responses to food shortages. Regardless of the explanation, this pattern further motivates us to focus on the previous-period food aid shipment as our measure of food aid supply to local markets, rather than relying solely on the contemporaneous food aid shipment.

### *Price Effects Across Regions and Commodities*

Nine regressions representing three commodities and three markets were estimated simultaneously to explore the impacts of food aid on local prices. Results for these regressions are reported in table 1. Results are organized by commodity. Although systemwide goodness-of-fit measures are available (e.g., McElroy 1977), all suffer from serious shortcomings in that they obscure variation in fit across equations. As a result, we choose to report each individual equation's goodness-of-fit measure ( $R^2$ ) along with our parameter estimates. In general, the models fit well and explain 80% or more of the total variation in price, on average.

Statistically strong food aid effects appear in seven of the nine price series. A price-depressing effect is indicated by a negative coefficient on the lagged value of the food aid shipment. Current food aid shipments are



**Figure 1. Domestic food prices in Ethiopia, 1996–2006**



**Figure 2. Domestic food production and food aid in Ethiopia, 1996–2006**

positively correlated with price, in a few cases at standard significance levels. We believe this positive correlation probably reflects occasions when, faced with a poor harvest, food prices and food aid shipments simultaneously increase, but then fall following the distribution of imported food. This pattern is consistent with a conjecture that food aid shipments are slow to reach markets. Such delays could be either due to early shipments following early warnings (as in 2003) or due to inefficiencies in the distribution system. In either case, the regressions strongly indicate that lagged values of food aid are negatively correlated with prices in all markets and commodities. The statistical strength of these individual point estimates varies across markets and commodities, however.

Comparisons across markets indicate that prices in producer (surplus) markets and consumer (deficit) markets are correlated with food aid shipments in similar patterns. Joint Wald tests are used to test the null hypothesis that food aid does not affect the prices of all commodities in a market. Results are reported in the final row and column of table 1 and lead us to reject the hypothesis for all markets at a 0.10 significance level. On average, a 1% increase in annual per capita food aid reduces monthly price by as much as 5%. This effect is slightly stronger at Markos than elsewhere, a result consistent with the price transmission performance of grain markets in Ethiopia. For example, previous studies (Getnet 2007; Getnet, Verbeke, and Vianene 2005; Negassa 1998) indicate that markets are well integrated. To confirm this pattern for our own data, we employ bivariate Granger causality tests of price relationships across spatially separated markets. These tests answer the question of whether an observed commodity's market price can help forecast a different commodity's market price. An exhaustive pattern of strong bidirectional causality means that any shock, regardless of its origin, is eventually and completely transmitted to all other markets. Although the use of such tests remains open to question (Hamilton 1994), our results (see Tadesse and Shively 2009) do suggest prices in all three markets respond to each other, without any single market serving as price leader. As a result, one might reasonably conclude that food aid effects filter to all regions, irrespective of where food aid has been distributed.

Results in table 1 also indicate that prices of domestically marketed international com-

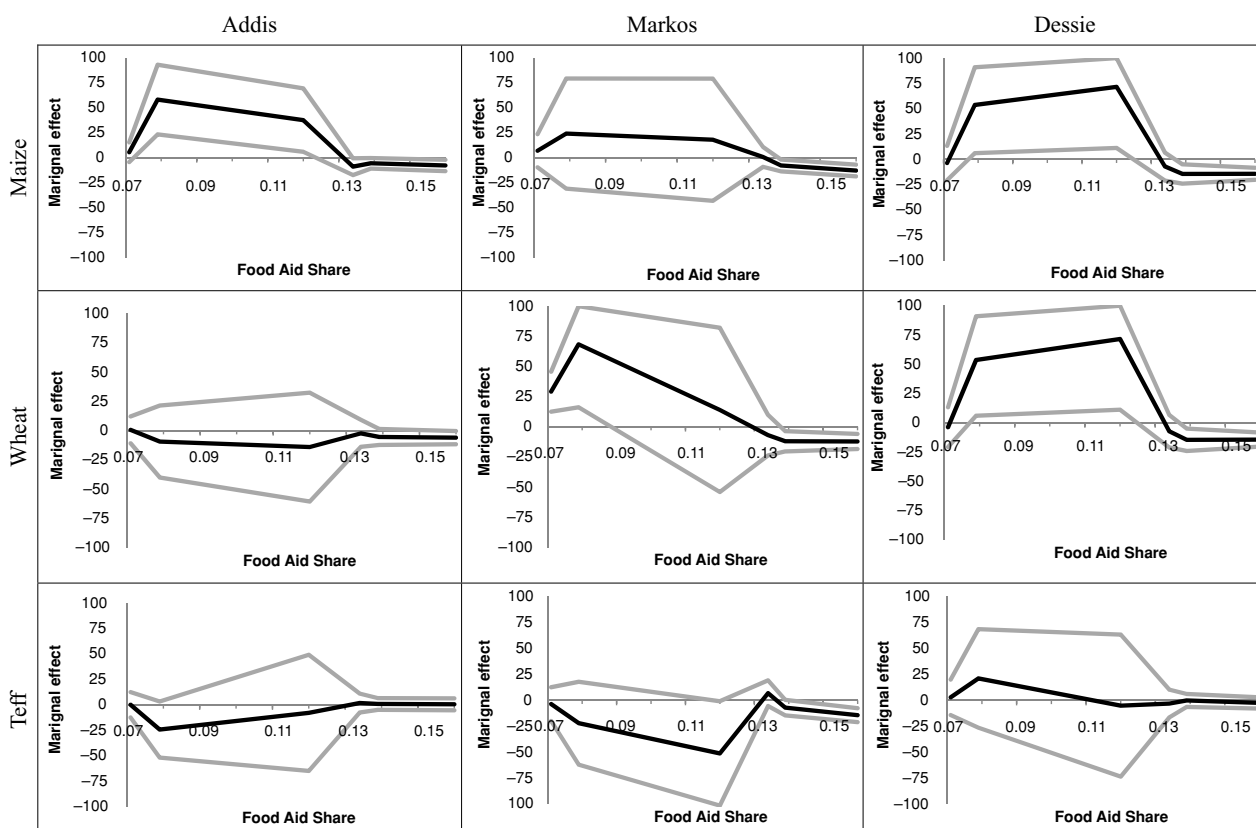
modities are more greatly affected by food aid shipments than are prices of the nontradable commodity. Food aid has a strong correlation with maize and wheat prices in all markets, and these individual point estimates are statistically significant at standard test levels. The correlation with teff, in contrast, is weak in both magnitude and significance, and appears responsive to food aid only at Markos. Joint significance tests for each commodity (in the final column of table 1) also indicate the price effect is statistically significant only for maize and wheat. Additional evidence for the weak price effect for teff is reflected in the Granger causality tests. We conclude that, at least at the margin, teff prices are formed largely exogenously to other commodity prices.

#### *Does the Magnitude of Food Aid Matter?*

One issue that could be relevant for policy is whether local prices respond to the level of food aid. From a conceptual point of view, equation (5) suggests this possibility. Accordingly, we test whether local markets display a threshold response to food aid using a recursive regression framework. In our data, the proportion of food aid in the domestic food supply ranges from 1 to 16%. We begin with a regression that contains observations for years in which the food aid share does not exceed 7%. We then expand the data set incrementally, including observations for years in which the food aid share is increasingly larger and excluding the same number of observations for years in which the food aid share is low. We follow this procedure for all markets and all crops. Regression results are reported by Tadesse and Shively (2009), and summarized graphically in the six panels of figure 3. Each panel corresponds to a market-commodity combination and displays the estimated marginal effect along with the 95% confidence interval around this estimate, based on the argument that the *t*-ratio for the estimated parameter of interest is the relevant result with which to identify threshold effects (Tsay 1991).

The marginal effects displayed in the panels of figure 3 correspond to the real price changes (in ETB) that are associated with an increase in the per capita food aid shipment. The graphs indicate a nonlinear relationship between food aid and price changes. The basic pattern is for the estimated effect to decline in magnitude and strengthen in significance as the food aid share increases. The statistical precision of the estimates improves markedly beyond food aid





Note: Figure 3 displays the relationship between the marginal effects of food aid on prices and the food aid share. The dark lines display the coefficient estimate. Lighter lines represent upper and lower bounds for confidence intervals. If zero lies within the confidence interval, the marginal effect is not significant at a 0.05 significance level. Regression results used to derive these panels are reported by Tadesse and Shively (2009).

**Figure 3. Estimated marginal effects of food aid, conditional on food aid share**

shares of approximately 10%. The pattern is especially clear for maize and wheat, and much less certain for teff: out of three markets, only one is associated with a statistically significant correlation between the teff price and the food aid share.

Figure 3 also shows that the price-dampening effects of food aid on wheat and teff seem to be more pronounced in Addis Ababa than in other markets, particularly at low levels of the food aid share. This likely reflects immediate reductions in outflow of grain from Addis to regional markets even when the incoming amount of food aid is very small. Food aid disrupts markets not only by dampening prices but also by reversing the local flow of foodstuffs. Regardless of the size of the shipment, in the presence of food aid traders have reduced incentives to transfer grains from Addis to deficit regions. As a result, when shipments are proportionately small, the Addis grain market appears to be more responsive to food aid than other markets.

The revealed patterns could arise from the relative power of food aid to create demand and discourage supply, and could also reflect poor absorptive capacity and low targeting ef-

iciency. We previously showed, via equation (5), that whether food aid boosts demand and discourages supply ultimately depends on the size of the food aid share. We conjecture that if the volume of food aid falls within a local market's absorptive capacity, which depends of course on the relative size of the populations of net sellers and net buyers during a food crisis, the food aid effect remains modest. Food crises arise from failures of food availability or from failures of purchasing capacity. Markets will have lower absorptive capacity under the latter than the former (Devereux 1988). As the flow of food aid exceeds the management capacity of food aid distribution agencies, targeting becomes highly inefficient. The result is that targeting inefficiencies, whether defined across individuals, geography or time, flood food markets and depress prices.

#### *Conditioning Food Aid to Shortfalls*

Abdulai, Barrett, and Hoddinott (2005) recommend that analyses of food aid should treat food aid as endogenously determined with local production, and that in such analyses disincentive effects will largely disappear.

We are inclined to concur with this view up to a point, but we further suggest that the overall nature of endogeneity at the household and market levels may be quite different, and that an ideal food aid program would be cognizant of and responsive to local—and not just national—levels of food production. Unfortunately, many examples serve to illustrate that food aid is frequently undertaken, irrespective of the domestic food production situation. Late arrivals and distributions due to administrative inefficiencies, slow response by the international community, and the presence of in-kind development assistance are some of the factors that lead aid agencies to undertake ill-informed food aid shipments. To underscore the importance of this point, we conclude our analysis by briefly illustrating how the impact of a unit of food aid imported during a surplus period differs from that shipped during a deficit period. Our goal is to identify a strategy that might contribute to reducing disincentive effects.

At the outset, however, we point out the challenge of defining periods as either surplus or deficit in areas where production is almost always below the required amount. Two options are available. To us, the most logical option seems to be to calculate the annual per capita cereal demand based on daily calorie requirements. The shortcoming with this approach is that one must know the share of cereals in a household's daily food budget and also assume that the daily calorie requirement translates to effective demand. Another option is to use the long-run average level of production, assuming it is an equilibrium outcome of supply and demand and reflects typically production opportunities. In practice, the two approaches give strikingly similar results for Ethiopia. We therefore proceed using a value of 135 kg of grain per person per year as our dividing line between surplus and deficit periods. This amount is equal to the long-term average domestic supply and the WFP per person cereal requirement (WFP 1998). We classify years as either deficit or surplus and then repeat our SUR regressions for these subsamples of the data. By this method, we identify seventy-two months in our sample as deficit and fifty-three months as surplus.

Parameter estimates for the food aid variable from these subsample regressions are reported in table 3. (For full regression results, see Tadesse and Shively 2009.) The entries in the table make it very clear that food aid effects differ markedly depending on when imports

**Table 3. Estimated Coefficients for Food Aid Effects During Surplus and Deficit Periods**

Market-Commodity	Deficit Periods ( <i>n</i> = 72)	Surplus Periods ( <i>n</i> = 53)
Markos-Maize	-3.49 (1.34)	-16.68 (3.20)***
Markos-Wheat	3.67 (1.05)	-11.95 (2.88)***
Markos-Teff	7.92 (2.56)**	-12.01 (3.23)***
Dessie-Maize	0.99 (0.35)	-7.89 (1.85)*
Dessie-Wheat	2.42 (0.71)	-4.55 (1.34)
Dessie-Teff	5.78 (2.13)**	-6.80 (1.85)*
Addis-Maize	5.50 (1.89)*	-6.48 (2.66)***
Addis-Wheat	1.63 (0.55)	-10.51 (3.41)***
Addis-Teff	0.87 (0.43)	-5.08 (1.42)
<i>N</i>	72	53

Note: *t*-statistics are in parentheses. Single, double, and triple asterisks represent statistical significance at the 10%, 5%, and 1% levels.

arrive. Regressions for deficit periods are insignificant in all instances, with two exceptions, both corresponding to positive correlations with teff prices. From this we conclude that food aid produces no significant disincentive during deficit periods. In contrast, all nine estimated coefficients for food aid are negative for the surplus subsample, and seven of these nine are statistically significant at standard test levels. From this we conclude that food aid that arrives in the absence of a major production shortfall will depress prices. This finding underscores that, were food aid properly and efficiently planned and delivered, it would not likely threaten long-run production. Of course such an argument is not new, and is one justification for recent efforts to buy food grains locally and then redistribute within country. However, data suggest that in recent history substantial food aid shipments to Ethiopia as well as program aid and FFW projects have been undertaken during periods of good harvest (recall figure 2). We do not wish to undermine the valid argument that targeting needy people only at specific times may be challenging and costly. Moreover, in a country where food aid helps not only to save lives but also to fulfill political objectives and secure development assistance, removing food aid inefficiencies will remain institutionally complex. Nevertheless, our

findings confirm that production-sensitive targeting could improve the logic of food aid and avoid creating disincentives for domestic producers.

### Conclusions and Policy Implications

This article confronts a popular theme in the food aid literature, namely that food aid depresses local food prices and results in production disincentives. We hypothesize that the link between food aid and possible price-induced disincentives depends on circumstances that govern the functioning of markets. To test this hypothesis, we examine evidence over spatially separated markets, domestically marketed international commodities and the nontraded local staple, and food-surplus and food-deficit periods.

Our results confirm the existence of substantial food aid effects on local food prices in Ethiopia. However, we find this effect varies in magnitude and statistical significance across circumstances. Due to the strength of market integration, food aid effects are transmitted widely. Producers in surplus regions are as likely to be affected as producers of deficit regions, and by a similar magnitude, but the effect seems confined to those international commodities that are widely marketed within Ethiopia.

We disaggregate the food aid effect across a range of periods characterized by the relative proportion of food aid in overall food availability. We find that food aid reduces prices, and may introduce disincentives to producers if shipments exceed the absorptive capacity of local markets. For the range of experiences studied here, a 10% food aid share seems to be a critical threshold. Above this point, food aid has an increasingly deleterious impact on local prices. We show that conditioning food aid to domestic production can reduce such disincentives. The key lesson for food aid policy is that targeting should become production-sensitive: to avoid disincentives, food aid should be provided only during periods of true production shortfall.

[Received June 2008;  
accepted May 2009.]

### References

- Abdulai, A., C.B. Barrett, and J. Hoddinott. 2005. "Does Food Aid Really Have Disincentive Effects? New Evidence from Sub-Saharan Africa." *World Development* 33(10):1689–1704.
- Awudu, A., C. R. Barrett, and J. Hoddinott. 2005. "Does Food Aid Really Have Disincentive Effects? New Evidence from Sub-Saharan Africa." *World Development* 33(10):1689–1704.
- Barrett, C.B. 2001. "Does Food Aid Stabilize Food Availability?" *Economic Development and Cultural Change* 49(2):335–49.
- Bezu, S., and S. Holden. 2008. "Can Food-for-Work Encourage Agricultural Production?" *Food Policy* 33(6):541–49.
- Bezuneh, M., and B. Deaton. 1997. "Food Aid Impacts on Safety Nets: Theory and Evidence: A Conceptual Perspective on Safety Nets." *American Journal of Agricultural Economics* 79(2):672–77.
- Bezuneh, M., B. Deaton, and S. Zuhair. 2003. "Food Aid Disincentives: The Tunisian Experience." *Review of Development Economics* 7(4):609–21.
- Clay, D.C., D. Molla, and D. Habtewold. 1999. "Food Aid Targeting in Ethiopia: A Study of Who Needs It and Who Gets It." *Food Policy* 24(4):391–409.
- Devereux, S. 1988. "Entitlements, Availability and Famine: A Revisionist View of Wollo, 1972–74." *Food Policy* 13(3):270–82.
- Elliesen, T. 2002. "Imported Dependency: Food Aid Weakens Ethiopia's Selfhelp Capacity." Bonn: InWEnt—Capacity Building International.
- Fafchamps, M. 2004. *Rural Poverty, Risk and Development*. Cheltenham: Edward Elgar.
- Gabre-Madhin, E.Z. 2001. *Market Institutions, Transaction Costs, and Social Capital in the Ethiopian Grain Market*. Research Report No. 124. Washington, DC: International Food Policy Research Institute.
- Gelan, A.U. 2007. "Does Food Aid Have Disincentive Effects on Local Production? A General Equilibrium Perspective on Food Aid in Ethiopia." *Food Policy* 32:436–58.
- Getnet, K. 2007. "Spatial Equilibrium of Wheat Markets in Ethiopia." *African Development Review* 19(2):281–303.
- Getnet, K., W. Verbeke, and J. Viaene. 2005. "Modeling Spatial Price Transmission in the Grain Markets of Ethiopia with an Application of ARDL Approach To White Teff." *Agricultural Economics* 33(3):491–502.
- Gujarati, D.N. 2003. *Basic Econometrics*. New York: McGraw-Hill.
- Hamilton, J.D. 1994. *Time Series Analysis*. Princeton: Princeton University Press.
- Heigh, I., and L. Dumoulin. 2008. "2008 Ethiopia Food Crisis Logistics Planning, Part I of II: Information Collection, Analysis and Supply

- Recommendations Version 1.5." Geneva: International Federation of Red Cross and Red Crescent Societies. Available at: <http://www.ifrc.org/docs/pubs/disasters/horn-of-africa/logistics.pdf> (accessed June 5, 2009).
- Holden, S., C.B. Barrett, and F. Hagos. 2006. "Food-for-Work for Poverty Reduction and the Promotion of Sustainable Land Use: Can it Work?" *Environment and Development Economics* 11(1):15–38.
- Jayne, T.S., J. Strauss, T. Yamano, and D. Molla. 2001. "Giving to the Poor? Targeting of Food Aid in Rural Ethiopia." *World Development* 29(5):887–910.
- Lentz, E., C.B. Barrett, and J. Hoddinott. 2005. "Food Aid and Dependency: Implications for Emergency Food Security Assessments." Available at SSRN: <http://www.ssrn.com/abstract=1142287> (accessed June 5, 2009).
- Levinsohn, J.A., and M.S. McMillan. 2005. "Does Food Aid Harm the Poor? Household Evidence from Ethiopia." NBER Working Paper No. W11048. Available at SSRN: <http://www.ssrn.com/abstract=648950> (accessed June 5, 2009).
- Little, P.D. 2006. "Are Ethiopia's Farmers Dependent on Food Aid?" Unpublished, University of Kentucky.
- McElroy, M.B. 1977. "Goodness of Fit for Seemingly unrelated Regressions: Glahn's  $R^2_{y,x}$  and Hooper's  $r^{-2}$ ." *Journal of Econometrics* 6:381–87.
- Negassa, A. 1998. "Vertical and Spatial Integration of Grain Markets in Ethiopia: Implication for Grain Market and Food Security Policies." Addis Ababa: Ministry of Economic Development and Cooperation.
- Sadoulet, E., and A. de Janvry. 1995. *Quantitative Development Policy Analysis*. Baltimore: The Johns Hopkins University Press.
- Schultz, T.W. 1960. "Value of U.S. Farm Surpluses to Underdeveloped Countries." *Journal of Farm Economics* 42(5):1019–30.
- Singh, I., L. Squire, and J. Strauss, eds. 1986. *Agricultural Household Models: Extensions, Applications, and Policy*. Baltimore: Johns Hopkins University Press.
- Tadesse, and G. Shively. 2009. "AJAE Appendix: Food Aid, Food Prices and Producer Disincentives in Ethiopia." Available at: <http://www.ageconsearch.umn.edu/>.
- Tsay, R.S. 1989. "Testing and Modeling Threshold Autoregressive Processes." *Journal of the American Statistical Association* 84(23):1–240.
- . 1991. "Modeling Nonlinearity in Univariate Time Series Analysis." *Statistical Sinica* 1(43):1–452.
- Tschirley, D., C. Donovan, and M.T. Weber. 1996. "Food Aid and Food Markets: Lessons from Mozambique." *Food Policy* 21(2):189–209.
- Webb, P., J. Von Braun, and Y. Yohannes. 1992. "Famine in Ethiopia: Policy Implications of Coping Failure at National and Household Levels." Research Report No. 92. Washington, DC: International Food Policy Research Institute.
- Wemos Foundation. 2005. "Dumping Food Aid: Trade or Aid? (Subsidized) Food Aid in Kind: What Is in It for the WTO." Amsterdam: Wemos Foundation and Food Trade and Nutrition Coalition. Available at: [http://www.wto.org/english/forums\\_e/ngo\\_e/posp47.dumping\\_food\\_aid\\_e.pdf](http://www.wto.org/english/forums_e/ngo_e/posp47.dumping_food_aid_e.pdf) (accessed June 5, 2009).
- WFP. 1998. "Special Report FAO/WFP Crop and Food Supply Assessment Mission to Ethiopia." World Food Program.
- Wooldridge, J.M. 2002. *Econometric Analysis of Cross Section and Panel Data*. London: The MIT Press.

# Paper II



# Speculation and Commodity Price Dynamics in Ethiopia

Getaw Tadesse\* and Atle Guttormsen

Department of Economics and Resource Management,  
Norwegian university of Life Sciences  
P.O.Box 5003; 1432 Ås ; Norway  
E-mail: [getaw.gebreyohanes@umb.no](mailto:getaw.gebreyohanes@umb.no)  
[atle.guttormsen@umb.no](mailto:atle.guttormsen@umb.no)

**Abstract:** *In an attempt to identify price stabilization strategies and rationalize public intervention in buffering markets, this paper investigates the intertemporal dynamics of commodity prices in Ethiopia. The classical rational expectation models are modified to account for seasonal distribution of shocks. The predictions of the structural models are reduced to computable periodic threshold autoregression. Several nonlinearity tests are applied to detect threshold effects. A regime-switching normalized maximum likelihood method is formulated to estimate thresholds and threshold autoregression parameters using monthly data from Ethiopia for the period 1996–2006. The result confirms the presence of periodic price thresholds that could be formed as a result of speculative storage. Comparison of price movements below and above thresholds indicates that prices are more correlated below the thresholds than above them. However, the effect on error variance is not very strong. Moreover, the temporal arbitrage, which is the gross return from speculative storage, is modest. The long- and short-term implications of the findings are discussed within the context of ongoing policy debates.*

JEL classification: Q11; Q13; C22; E31

Keywords: speculation, price volatility, price thresholds, grain storage, Ethiopia

---

\*permanent address: Hawassa University, P.O.Box 05, Hawassa, Ethiopia; E-mail:

[getawtadesse@yahoo.com](mailto:getawtadesse@yahoo.com)

## Introduction

The justification for state intervention in stabilizing agricultural prices has long been questioned (Newbery and Stieglitz, 1981). Nevertheless, continually increasing price

uncertainty and its adverse effect on producers and consumers (Sadoulet and deJanvry, 1995, Sahn and Delgado, 1989) present both an opportunity and a challenge for policy making with regard to defining an appropriate state role in terms of price risk management. The sources of price volatility, particularly for storable commodities, have long been unclear. Deaton and Laroque (1992) argued that the variability of commodity supply shocks, inelastic demand and the behavior of speculators are the chief drivers of this volatility. Many observers in Ethiopia, for example, believe that opportunistic speculation<sup>1</sup> (hoarding) by grain traders is the major culprit for the ever increasing price instability (Loening, et al., 2008). The government of Ethiopia has repeatedly stated that opportunistic or greedy behavior by traders is causing the price volatility and sustained price rise. The government is suspicious of the rationality of speculators' expectations and neutrality of the price dynamics from their manipulation. Consequently, the government has taken a number of measures to control speculative storage of grains. Such observation poses an important empirical question: how important and competitive is speculative storage in characterizing commodity price behavior?

Since Gustafson (1958), many economists have attempted to systematically investigate the role of commodity storage in price dynamics using classical commodity storage theory (Deaton and Laroque, 1992, Scheinkman and Schechtman, 1983, Wright and Williams,

---

<sup>1</sup> "Speculation" in this paper refers to the act of keeping inventories, with the expectation that the future price will be higher than the current price. The primary motive of speculative trade is to generate profit. Government storage for stabilizing prices is not considered speculative storage. Terms such as "storage trade" and "intertemporal arbitrage trade" are used synonymously with the term "speculative storage". "Hoarding" is a term sometimes used to indicate a higher degree of speculative storage.



1982). In the presence of adequate information on stock and price time series, analyzing the effects of speculative storage on price dynamics is not very problematic. However, information on stock time series is scant. Commodity price data, on the other hand, are easily available and can be obtained for years and months. The issue then is whether we can provide a robust judgment using the available price information alone. Previous studies that used only price data applied two competing methods. The first method relies on simulation of the structural equation using dynamic programming (Osborne, 2004) and the second method relies on estimation of the reduced equation using threshold analysis of observed price series (Shively, 2001). The latter assumes an identically and independently distributed shock at harvest that translates into a constant threshold in all periods. This assumption could be restrictive, particularly for developing countries where production remains constant over seasons and varies over years. Chambers and Bailey (1996) relaxed this assumption and developed dynamic threshold models. However, their estimation requires extensive algorithms and makes the model cumbersome for empirical applications.

In response to these perceived shortcomings in the previous approaches, we refine the Chambers and Bailey (1996) periodic threshold model to make it suitable for explaining speculative behavior under different circumstances and testing using regime-switching maximum likelihood estimation. Then, we apply it in Ethiopian setting where markets are thin, production is stochastic and interregional trade is limited. The paper is guided by three major objectives. First, it tests the presence of threshold effect within the Ethiopian grain prices dynamics. Second, it examines the effect of speculation on price volatility (autocorrelation and variance). Third it evaluates the efficiency of the temporal arbitrage.

By doing so, we argue that price formation in Ethiopia is consistent with the prediction of storage model in which investment on speculative storage is made under rational expectation. It is our hope that the study contributes to the ongoing debate regarding the behaviors of commodity prices and anti-speculative storage policy interventions.

The rest of the paper is organized as follows. Section 2 presents background information regarding price dynamics and storage conditions in Ethiopia. Section 3 explains the theoretical foundation of the relationship between speculative storage and price dynamics. Section 4 outlines the econometric methods that are employed to estimate the parameters of different threshold models. The data sources are explained in section 5. Starting with tests of nonlinearity, section 6 presents and discusses the estimated results. The final section provides concluding remarks and policy implications.

### **Grain prices and storage in Ethiopia**

The grain marketing system and the spatial movements of Ethiopian grain prices have been widely examined (Getnet, 2007, Getnet, et al., 2005, Negassa, 1998, Negassa, et al., 2004). The studies implied that the spatial integration of major regional markets into central and other regional markets is fairly strong; vertical integration between wholesale and retail markets is satisfactory; and inter commodity price transmission is very strong. Such integrations become more effective as a result of increased expansion of road and communication networks. However, little is known about how prices are evolving over time and how the storage behavior of traders and farmers affects this evolution.

Monthly retail price data from 1996 to 2006 do not show any significant downward or upward trend until the end of 2005, when the 2007–2008 food price hike commences (see

figure 1). More surprising is that there was no significant difference between nominal and real price trends before 2006. However, the relative price trend changed after this time. Nominal prices show an increasing trend for both teff and maize. The real price for teff also increased, although the trend is not as sharp as the nominal price trend. Contrary to expectations, the real price of maize declined despite the sharp increase in its nominal price. In addition, it has been found that the difference between nominal and relative (real) prices has been growing in recent times. However, more recent information indicates that the price of food has increased more than the general price level (Loening, et al., 2008).

A rise or decline in price is not as bad as variability. In Ethiopia, price volatility and, more recently, food price inflation remain the overriding national concerns. Post reform grain prices are subject to significant and continuing inter-annual price volatility that ranks among the highest in the developing world. Monthly price instability, an indication of a market's relative performance in realizing arbitrage opportunities, has also worsened in the most recent period. Between 1996 and 2006, monthly grain prices exhibited an average variability of 23%. A substantial price collapse in 2001 resulted in a situation where many farmers were unable to cover even their fertilizer costs. By contrast, in 2006, the price of all food grains in all markets increased by as much as 80% (MoARD, 2006). There is a growing belief that prices in Ethiopia tend to keep on rising once they have experienced an initial increase, with the implication that market prices are generated in a process that operates differently at different times and does not favor a random walk hypothesis. Figure 2 shows monthly real price changes from February 1996 to July 2006. Both teff and maize prices experience long spikes in their downward and upward swings. However, the spikes were less frequent in the

upward swing than in the downward swing. In other words, price slumps were more frequent than booms.

The functioning of storage and speculation may explain the presence of long spikes and extended troughs in grain price dynamics. Information related to the functioning of commodity storage in Ethiopia is very scarce. A few studies on market structures and performances (Dessalegn, et al., 1998, Gabre-Madhin and Amha, 2005) indicate that the major economic agents who hold grain stock for speculation purposes are wholesale private traders and farmers. Grain commodities are stored for a range of periods. Whereas short-term storages are meant to overcome the fixed costs of transacting, long-term storages are intended to earn profits from future price speculation, which we sometimes refer to as temporal arbitrage. Most wholesale traders store grain in order to earn profits from price differences across seasons (Amha and Gabre-Madhin, 2005). Prices are usually lower during harvest and hence, traders buy during this time with the expectation that the price will rise during lean seasons. If the price remains the same, they keep the grain for the next year. However, such a decision is very stochastic and dependent on an individual trader's risk-aversion behavior, expectations about future harvests and other possible shocks. According to Dessalegn, et al. (1998), more than 80% of wholesale traders hold grain stocks for up to six months, 13% for up to 12 months and 5% for more than one year. Although few traders keep grain for more than one year, the amount of grain that they hoard is relatively large.

Smallholder farmers sell the bulk of their produce right after harvest to pay taxes and loans and to meet their cash requirements for social services. They sell their produce piece by piece, in small quantities, depending mainly on the cash requirements of families.

However, few farmers store grain for long periods in order to benefit from temporal arbitrages.

Storage cost is generally very high in Ethiopia. Based on a trader survey in 1996, Dessalegn et al. (1998) estimated an average storage cost of ETB 54/ton/month. This is composed of storage losses (9.2%), storage rent (16.15%), fumigation costs (9%), the opportunity cost of tied capital (24%), labor (12.77%), materials (9.67%) and others (19.21%). These costs vary greatly from commodity to commodity because of differences between commodities in terms of storage losses and the value of tied capital.

Institutional interventions to stabilize grain prices are limited to buffer stocking and organizing producer cooperatives to hedge price risks by themselves. Buffer stocking is officially handled by the Ethiopian Grain Trade Enterprise, which is mandated to stabilize producer and consumer prices and maintain buffer stocks for market stabilization. The Enterprise has a storage capacity that holds about seven million quintal, which accommodates only 18% of the total grain marketed every year. As a strategy for stabilizing price, the Enterprise buys when grain prices are low and stores grain until the price goes above a ceiling price. However, the Enterprise's operations have an insignificant impact on market prices. For example, in 1996, the Enterprise's direct purchases from farmers represented only 2% and 2.6% of the total marketed quantity of maize and wheat, respectively (Bekele, 2002). The other new initiative to hedge price uncertainty was the establishment of the Ethiopian Commodity Exchange (ECX) in 2008. The ECX was established to formally coordinate the exchange of commodities and futures among wholesalers,

exporters, speculators and millers. It has targeted six commodities: maize, wheat, teff, pea beans, sesame and coffee. However, it is not yet fully functional.

### **Speculation, storage and price dynamics**

Speculation has long been recognized as having a substantial impact on the price dynamics of storable commodities (Williams and Wright, 1991). The explanation is straightforward. If the market offers temporal arbitrage opportunities because of supply fluctuations, profit-maximizing traders will engage in intertemporal trading. These speculators buy when the price is low and sell when the price rises so that the price difference across time will depend only on storage costs and the opportunity cost of capital. Thus, speculative storage could cause prices to stabilize over seasons in the short run. However, because of the non-negativity constraint on stocks, stockholding behavior will be more effective in moderating the downward than the upward movement. This leads to the observation that commodity price cycles will typically exhibit a long flat bottom, interrupted by occasional sharp spikes, commonly referred to as nonlinearity<sup>2</sup> in price dynamics. The nonlinearity is primarily attributed to the fact that inventories cannot be negative (Gustafson, 1958). The nonnegativity constraint imposed on optimization of stock holding allows prices to behave differently below and above certain thresholds.

To comprehend this conjecture, the rational expectation model of Williams and Wright is reformulated as follows (Williams and Wright, 1991). To begin, the basic theoretical price

---

<sup>2</sup> "Nonlinearity" is the term used to indicate structural breaks in price dynamics. Nonlinearity can be caused by a range of structural conditions, such as policy changes, shocks, storage, etc. "Threshold nonlinearity" is used to refer to structural breaks in price series owing to a threshold variable (lagged price) that affects storage decisions.

formation process is presented with independently and identically distributed (i.i.d.) supply shocks and a constant opportunity cost of tied capital. Consider a grain market in which risk-neutral speculators engage in storage trade. Further, assume that the traders utilize all available consumption and production information to set future expected prices. Let the grain price at time  $t$  be  $p_t$ , and the annual harvest be  $h_t$ , which is i.i.d. because of weather variability. In the absence of storage, in a closed economy,<sup>3</sup> the total consumption is exactly equal to the total harvest so that price entirely depends on the stochastic harvest:

$$p_t = f(h_t) \quad (1)$$

Equation (1) represents the inverse demand function, where demand is equal to supply at equilibrium ( $q_t = h_t$ ). In this framework, price follows an i.i.d. process. No serial correlation is expected as long as the harvest is i.i.d.

In the presence of profit-maximizing and risk-neutral speculators in the market, both the demand and the supply will change to account for storage in such a way that:

$$x_t = h_t + S_{t-1}, \quad (2)$$

where  $x_t$  is the state variable that consists of the stochastic harvest and the carryover level of grain from the previous period ( $S_t \geq 0$ ). This is the available grain at any time, either for current consumption or for storage. Using equations (1) and (2), the price formation equation becomes:

---

<sup>3</sup> The closed economy assumption will be maintained throughout the paper. The assumption is particularly realistic in the case of Ethiopia, where exports are officially banned for some grains including teff and where commercial imports are very rare. Food aid might be relevant but it affects the price level more than price volatility.

$$p_t = f(x_t - S_t). \quad (3)$$

Storage in this case is a decision variable that must be determined from the speculator's problem. The speculator's problem is to determine the discounted optimal level of storage that maximizes net profit, subject to storage cost and the equation of motion(3). Deaton and Laroque (1992) showed that a formal derivation of the problem provides a unique stationary rational expectation equilibrium (SREE) at the optimal market price  $p_t$  :

$$p_t = \max \left\{ f(x_t - S_t), (E(f(h_{t+1} + S_t)))(1 - c) / (1 + r) \right\}, \quad (4)$$

where  $c$  represents the marginal cost of storage, which includes all variable costs related to managing inventory and inventory decay, and  $r$  represents the market interest rate. The first term in parentheses in equation (4) indicates the gain from consuming a unit of grain currently, whereas the second term shows the expected and discounted gain from storing grain for one more period. The expectation is made based on the realized current period stock and the expected future harvest. Here, storage is assumed to be a windfall strategy whereby speculators do not plan to store ahead of time. This means that expected future storage has no effect on current period price expectations.

The SREE of equation (4) implies the following temporal arbitrage conditions.

If  $f(x_t - S_t) \geq (E(f(h_{t+1} + S_t)))(1 - c) / (1 + r)$ , then  $S_t = 0$  and the market price reduces to (1). Substituting  $E(f(h_{t+1} + S_t)) = E(P_{t+1})$ , from equation (3) where  $S_{t+1} = 0$ , one obtains:

$$P_t \geq (E(P_{t+1}))(1 - c) / (1 + r). \quad (5)$$

As consuming today provides higher value than storing, storage becomes zero and the price depends only on the level of harvest. The intertemporal connection is broken and, as a



result, the price series is expected to be less correlated than under an assumption of storage. Zero storage is a temporary outcome in response either to future speculation or to a high storage cost due to price risk, high costs of storage or a high opportunity cost of capital. If there exists any storage under such conditions, as commonly observed in developed economies, it must be attributed to a desire either for convenience or for ease of transaction (Chavas, et al., 2000).

If  $(E(f(x_{t+1} + S_t))(1-c)/(1+r) > f(x_t - S_t)$ , then  $S_t > 0$  and the market price is less than the expected gain from storage. That is:

$$P_t < E(P_{t+1})(1-c)/(1+r). \quad (6)$$

Equation (6) states that, along the optimal storage path, the current price must be lower than the discounted expected future price and the marginal storage costs. As storage is positive, prices are expected to be serially correlated. Furthermore, price volatility should depend not only on the stochastic harvest but also on the predetermined level of stocks. Thus, lower volatility is an equilibrium outcome of such a condition.

The i.i.d. assumption is restrictive and fails to adequately explain price dynamics at higher prices (Chambers and Bailey, 1996, Deaton and Laroque, 1996). Though, the correlation of harvest shocks is less likely in annual and rain fed crops, their distribution could possibly be time dependent (non-random). An important insight to deal with this problem is the use of periodic disturbances, where a period is represented by a month (Chambers and Bailey, 1996). The idea behind this approach is that harvest shocks in every period, say July in each year, are i.i.d. but the harvest shocks of July and other months, say August, might have different distributions. In this extension, however, we still assume that disturbances are

independent across time periods. Periodic disturbances offer a plausible and realistic assumption for empirical work using monthly price data. Let a period is represented by  $j=1,2, \dots,n$ , such that the mean and disturbances of the harvest are  $\bar{h}_j$  and  $v_j$ , respectively. The SREE can be modified to accommodate periodic disturbances as follows:

$$p_{ij} = \max \left\{ f(x_{ij} - S_{ij}), (E(f(h_{t+1} + S_{ij}))(1-c) / (1+r)) \right\}, \quad (7)$$

where  $t \in j$ .

Equation (7) implies that each period will have different rational expectation equilibrium, conditional on observed and expected harvests. In a periodic disturbance model, harvest shocks are identically distributed across years but differently across periods. An important insight emerged from this model is that speculative decision rule varies over periods. That is arbitrage conditions are different for different periods.

### Estimation methods

The major testable prediction derived from the commodity storage model in section 2 is that storage causes prices to behave differently above and below a certain decision price. The two arbitrage conditions described by equations (5) and (6) imply that there exists a price level  $p^*$  below which speculators maintain stock and prices are functionally related over time, and above which speculators do not maintain any stock and prices are disconnected. Thus, the reduced form of the SREE ((5) and (6)) is specified as:

$$E(p_{t+1}) = (1+r) / (1-c) \min(p_t, p^*), \quad (8)$$

where  $p^*$  is a "threshold" price. Assuming rational expectations on the part of agents, the stochastic form of (8) is:

$$p_t = (1+r)/(1-c) \min(p_{t-1}, p^*) + e_t, \quad (9)$$

where  $e_t$  is the disturbance associated with deviations from the actual price caused by demand and supply shocks.

The probability distribution of the random disturbance term ( $e_t$ ) has an important implication for the formulation and estimation of (9). The disturbance term could exhibit i.i.d., time-dependent and/or periodic distribution. Furthermore, the opportunity cost of capital ( $r$ ) may change over time as a result of structural policy changes. Such distinctions give rise to several different possible forms for the TAR. The i.i.d. assumption of supply shocks implies that the threshold remains constant over the entire sample period (Deaton and Laroque, 1992). The model<sup>4</sup> is specified as:

$$p_t = \begin{cases} \gamma_1 p_{t-1} + e_t & \text{if } p_{t-1} < P^* \\ \gamma_2 p_{t-1} + e_t & \text{if } p_{t-1} \geq P^* \end{cases} \quad (10)$$

where  $\gamma$ 's are parameters to be estimated from observed prices. As shown by (10), there is no intercept term to impose the arbitrage conditions restrictions.

Under the assumption of periodic disturbances, the threshold price,  $p^*$ , is no longer constant, but instead varies across periods. In particular, each period will have its own threshold price that speculators use for decision making. Thus, the periodic threshold form of (10) is:

---

<sup>4</sup> We restrict the model to a first-order autoregression based on the Akaike Information Criteria (AIC) test. For countries such as Ethiopia where speculators are poor, arbitrage may not last for more than a single period.

$$p_t = \begin{cases} \gamma_1 p_{t-1} + e_t & \text{if } p_{t-1} < p^{*k} \\ \gamma_2 p_{t-1} + e_t & \text{if } p_{t-1} \geq p^{*k} \end{cases} \quad (11)$$

$k = j \quad \text{where } t \in j$

We impose the same restriction on  $p^{*k}$  as Chambers and Bailey (1996). However, we restrict  $p^{*k}$  to take only two values, one for six consecutive months followed by another value for the rest of the months. The first six months are defined to be harvesting months and the others as non-harvesting months. This is because, first, the harvest for agricultural commodities occurs within a range of few months. Thus, harvest is identically zero for the rest of the months. This gives rise to the possibility that the disturbances within harvesting or non-harvesting months are identical but different across seasons. Second, traders' and producers' storage behaviors and decisions differ greatly over seasons compared with over months. Thus, besides controlling for periodic distribution of harvest shocks, our definition of a period based on a season helps to examine behavior under different seasons. Traders and producers usually presume a higher expected price during non-harvesting period than harvesting period to keep positive inventory. More importantly, defining a period as a month requires a minimum of 12 periods, which is very difficult for empirical estimation using small samples.

Imposing restriction on  $p^{*k}$  introduces additional assumption that shocks are identically distributed within the group of months. Empirically, the Durbin–Watson d-statistic is computed for each commodity and each group showed that disturbances are indeed i.i.d. within a season.

Provided that the error terms are normally distributed, equation (10) and (11) are estimated using regime-switching maximum likelihood estimation. For T independent observations, the log-likelihood function is given by:

$$L(\theta) = f(p_1, p_2, \dots, p_T | \theta) = -\ln \sigma + \sum_{t=2}^T \ln \phi(z_t), \quad (12)$$

where  $z_t = \frac{(p_t - \gamma p_{t-1})}{\sigma}$ ,  $\theta \in \{\gamma, \sigma\}$  and  $\phi(\cdot)$  denotes the standard normal distribution.<sup>5</sup> Equation (12) is modified for regime-switching regression using a probability function that identifies the probability of a given observation falling in a particular regime,  $i$ . The probability function,  $\rho_{it}$ , denoted as  $\rho(p_t \in i | p^*)$ , is defined as the probability of an observed price at time  $t$  falling in the  $i^{\text{th}}$  regime where  $i = 1$  if  $p_t < p^*$  and  $i = 2$  if  $p_t \geq p^*$ . Furthermore, it has been normalized using the proportion of observations within the regime (Hamilton, 1994). The normalized log-likelihood function is:

$$L(\theta) = (-\ln \sigma_1 + \sum_{t=2}^T \ln \phi(\frac{e_t}{\sigma_1})) \omega_1 \rho_{1t} + (-\ln \sigma_2 + \sum_{t=2}^T \ln \phi(\frac{e_t}{\sigma_2})) \omega_2 \rho_{2t}, \quad (13)$$

---

<sup>5</sup> The derivation of equation (13) from the probability density function proceeds as follows. Given the normal probability density function  $f(p | \gamma, \sigma) = \left(\frac{1}{2\pi\sigma^2}\right)^{1/2} \exp\left(-\frac{(p_t - \gamma p_{t-1})^2}{2\sigma^2}\right)$ , substituting  $z = \frac{p_t - \gamma p_{t-1}}{\sigma}$  and factoring out  $\frac{1}{\sigma}$ , we obtain  $f(p | \gamma, \sigma) = \frac{1}{\sigma} \frac{1}{\sqrt{2\pi}} \exp(-0.5z^2)$ , which is equivalent to the standard normal distribution  $f(p | \gamma, \sigma) = \frac{1}{\sigma} \phi(z)$ . For a sample of  $T$  i.i.d. normal random variables, the likelihood is  $f(p_1, p_2, \dots, p_T | \gamma, \sigma) = T \frac{1}{\sigma} \phi(z_1) \cdot \phi(z_2) \cdot \phi(z_3) \cdot \dots \cdot \phi(z_T)$ , taking the logarithm of this yields equation (12).

where  $\omega_i$  is the proportion of observations under regime  $i$ ,  $\omega_i = \frac{t_i}{T} = \frac{\sum_{t=2}^T \rho_i}{T}$  and  $\sum \omega_i = 1$ .

$\sigma_i$  is the variance for each regime;  $i = 1$  for the first regime where storage is positive and  $i = 2$  for the second regime where storage is zero. As implied by the storage model, the variance of the disturbance varies across regimes because of the existence of carryover stock in regime 1 that stabilizes price, whereas in regime 2, price depends entirely on the stochastic harvest and any other demand shocks (Wright, 2001). Thus, the error term is heteroscedastic for the entire sample but homoscedastic for each regime.

Estimating the parameters in equation (13),  $\theta \in \{\sigma_i, \gamma_i, p^*\}$  is difficult because of the nonlinearity of the equation with respect to  $p^*$ . Many complicated algorithms and methods are available in the literature that could estimate the parameters simultaneously (Hamilton, 1994). However, once  $\rho$  is exogenously determined, it is easy to estimate. Such probability determination requires a prior identification of the threshold value and its functional form. We assume a uniform switching probability function in which a given observation receives a probability of falling in a regime of either 1 or 0. A grid search method was applied to establish the threshold value. For a constant threshold model, 10 to 90 percentiles of the threshold variables were considered as candidates and equation (13) was run for each candidate. The one with the highest log-likelihood was taken as the optimal threshold value. The approach here follows Shively (2001), who studied the Ghanaian grain market. For periodic threshold models in which two thresholds are considered at a time,  $n_1 \times n_2$  candidates were evaluated, where  $n_j$  is the number of observations in period  $j$  that lies within the range of 10 to 90 percentiles.

## The data

The data are obtained from the records of the Central Statistics Agency of Ethiopia (CSA). We used prices from the Addis Ababa grain market. This is because Addis Ababa represents the major central market that receives grain from surplus-producing areas and distributes it to deficit areas. It is the major consumer market as it contains Ethiopia's largest urban population. It also serves as a producer market, particularly for surrounding teff-growing farmers, who are the major suppliers of teff in the country. In general, it best characterizes activities in the country's commodity markets and is conjectured to embody the basic pattern of the nation's food price dynamics.

Two major cereal grains, teff and maize, are included in the study. These crops account for more than 50% of national annual cereal production and consumption. Teff is a crop indigenous to Ethiopia and is widely used for making soft bread called *injera*. It appears in a range of qualities, with significant differences in prices. In this study, the price of the highest quality teff, called white teff, is used. Although both teff and maize grains are storable, teff is more storable than maize because of its resistance to pests in storage. However, teff is more expensive than maize and therefore requires more capital investment for storage.

A series of empirical models were estimated using monthly retail real prices covering the period from January 1996 to July 2006. This series was deflated using the monthly general consumer index published by the National Bank of Ethiopia. Prices were tested for nonstationarity using augmented Dickey–Fuller unit root tests. Although a hypothesis of nonstationarity cannot be rejected for nominal prices, real prices appear to be stationary. Not surprisingly, however, the price series are highly autocorrelated. First-order

autocorrelation coefficients are above 0.9 for all commodities. Higher-order autocorrelation coefficients are insignificant and a partial autocorrelation function graph shows a sharp decline after the first lag.

## **Results and Discussion**

### *Threshold effects*

Analyzing the intertemporal dynamics of commodity prices assists in ascertaining whether real prices exhibit nonlinearity. In this section, we explore the presence of threshold nonlinearity to determine the role of speculative storage in characterizing commodity price formation. Several test procedures were employed, including a general nonlinearity test (Tsay, 1991), a threshold nonlinearity test (Tsay, 1989) and Hansen and CUSUMQ tests (Greene, 2003). These tests generally test the presence of threshold effects without prior identification of the threshold value. All the tests are made on residuals of arranged recursive regressions in which the data are first arranged based on the threshold variable and then a series of regressions are carried out, starting from the full observation and advancing by dropping one observation at a time until a sufficient number of observations remains to run the last regression. Thus, each observation has its own parameters and residuals. The association of the parameters and residuals with the threshold variable is used to test the presence or absence of threshold nonlinearity. Test statistics of these types are presented in table 1.

The test results provide clear evidence of price thresholds. All tests confirm that there exists strong threshold nonlinearity in both teff and maize price dynamics, although the degree varies across tests and commodities. Tsay test predicts threshold effects more



strongly than do Hansen and CUSUMQ (see figure 3) tests. This is in line with previous findings that claim that the former tests are more powerful than the latter (Tsay, 1991, Tsay, 1989). The threshold effect appears to be stronger in teff than in maize. As teff is storable for longer periods than maize, extended slumps could be more apparent in teff than in maize. However, CUSUM square graphs reveal the possibility of more than one single threshold in maize price dynamics as the cumulative sum of the squared residuals exceeds the band formed by the lower and higher values of the threshold variable.

Table 2 reports the threshold values identified by grid search methods, stock out rates and Lagrangian ratio tests for thresholds. The threshold prices are expected prices above which speculators will not store grain and below which they tend to store grain expecting future price improvements. These prices are higher than the respective long term average prices by about 10 and 13 average points for teff and maize respectively. As the thresholds are identified based on rational expectations framework, a comparison of the threshold autoregression with a restricted first-order full-sample autoregression indicates whether the threshold effect is due to speculative storage. The likelihood ratio test reconfirms the presence of threshold effects and that these are indeed caused by speculative storage. The parameters of the restricted first-order autoregression are significantly different from those of the unrestricted threshold autoregressions. Both constant and periodic thresholds are statistically significantly different from zero. However, the periodic threshold for the teff price shows a very large  $\chi^2$  value, which supports the view that threshold values change periodically. The stock out rates, which indicate the probability of no speculative trade, are generally low. However, the rates observed here remain higher than stock out rates in

developed countries, where commodities are generally in surplus (Chambers and Bailey, 1996, Deaton and Laroque, 1996). As expected, maize has a higher stock out rate than teff. This is consistent with the fact that speculative trade is more common for teff than for maize. Correcting the seasonal effects of price correlation increases the likelihood of a stock out in the market. By contrast, the incidence of stockpiling falls when separate decisions regarding threshold prices are established for harvesting and non-harvesting periods. In general, the result indicates a very low incidence of trader holdups and confirms the significance of speculative behavior on price formation. In the next section, we will see the impact of such speculation on price correlation and volatility and examine whether the temporal arbitrage caused by the speculation is efficient.

#### *Effects of price thresholds on price volatility*

The effect of threshold nonlinearity on price correlation and variability was assessed using the parameters obtained from the regime-switching maximum likelihood estimation. We measure price volatility based on the size and variability of spikes generated by price shocks. If the correlation between price series is very high, then the size of amplitude will be smaller and hence the price is less volatile. If the variance of the current price series is very high, then the amplitude size is very variable and so is the price volatility. To compare autocorrelations and variances during price slumps where stock is positive, and during price booms where stock is zero, we estimated constant and periodic threshold autoregression models using the maximum likelihood method.

The results of the models are comparable (table 3). It is not clear from the recursive and nonrecursive tests which model best explains the patterns observed in the data. The models

seem essentially equivalent in explaining the observed price dynamics. However, a distinction is required to characterize the decision behavior of speculators and rationalize the right way of modeling commodity price dynamics in Ethiopia. A likelihood ratio test is used to test the hypothesis that thresholds are constant over periods. The test statistic is given as follows:

$$LR = 2 * (\ln L_0 - \ln L_p) \sim \chi^2(k = 1), \quad (14)$$

where  $L_0$  is the log-likelihood of the null hypothesis ( $H_0 : P^{*1} = P^{*2} = P^*$ ) and  $L_p$  is the unrestricted periodic threshold (their values are in table 3). The test statistics for teff and maize were 6.32 and 2.34, respectively. The hypothesis is rejected at a 5% level of significance for the teff price but cannot be rejected for the maize price. This implies that the periodic threshold model fits better than the constant threshold model, at least for the teff price series. In other words, unlike maize, teff production shocks are seasonally correlated. The difference in price dynamics across commodities could be attributed to the nature of production of the crops. As teff is a rain-fed crop, it is produced once per year and hence, an annual supply shock persists for the whole year. Unlike teff, maize is produced using *belg*<sup>6</sup> rains or irrigation so that production shocks remain identical through out the year. Thus, maize speculators have a constant mean threshold price whereas teff speculators need to adjust their threshold (decision) price seasonally.

---

<sup>6</sup> A short rainy season during winter

The overall result indicates that price autocorrelation is stronger with a stock regime (below the threshold) than it is without stock (above the threshold). A robust Wald-statistic corrected for unequal variance is used to test the equality of the correlation coefficients above (without storage) and below the thresholds (with storage). The test statistics, calculated following (Greene, 2003), show that the two price autocorrelation coefficients are statistically different for both commodities. The difference becomes more significant when a periodic threshold is used. This implies that speculative storage indeed moderates the downward movement of food prices in Ethiopia.

The effect of price thresholds on the variability of agricultural prices during slumps and booms is tested by comparing the variance of the disturbances above and below the thresholds. Slumps are less variable than booms in three of the four cases. To ensure the statistical significance of such differences, the following *F-statistics* were calculated:<sup>7</sup>

$$F = \frac{\sigma_2^2}{\sigma_1^2} \sim F(n_2 - k, n_1 - k). \quad (15)$$

The test reveals that storage trade has a significant impact on the volatility of the maize price but not on the volatility of the teff price, indicating that the incidence of stock holding per se makes no significant contribution to price stabilization. The demand structure of teff may help to explain why the teff market failed to stabilize price. The demand for teff is price elastic; when price is lower, the consumption demand increases, which immediately causes

---

<sup>7</sup> By convention, the larger variance appears as the numerator (see Gujarati, D. N. *Basic Econometrics* New York McGraw-Hill 2003.

the price to increase as supply is constant in the short run. Such fluctuations outweigh the stabilization effect of storage, unlike the case of maize, for which the demand is inelastic.

#### *Efficiency of temporal arbitrage*

We evaluated the extent of grain markets' inter-temporal efficiency by comparing the gross margin rate of return from investment in storage and the costs of storage. The annual rate of gross margin from investment in speculative storage was estimated as follows. Assuming that  $p_{t-1} < P^*$  and that  $S_t > 0$ , the monthly gross internal rate of return from inter-temporal trade,  $R$ , is estimated as  $R = \frac{P_t - P_{t-1}}{P_{t-1}} = \gamma - 1$ . The annual gross internal rate of return expressed in percentage terms is, thus,  $(\gamma - 1) * 12 * 100$ .

The result indicates that the annual gross margin rate of return ranges from 2.4% to 16.6% (table 3). These values represent the risk-free gain from storing grain for one more year. The variation in the rate of return across commodities is also in line with the variability in storage costs. Maize storage is more costly than teff. This is because maize has higher losses when stored for a longer period of time. The storage loss of maize over a six-month period in rural Ethiopia was reported as 23% to 33% (Dadi, et al., 1992). In 1996, storage cost accounts for 2% and 5% of the gross values of teff and maize, respectively (Dessalegn, et al., 1998). Given the high cost of storage and the low level of expected gross margin, temporal arbitrage generates insignificant profit. In other words, on average, the Ethiopian grain market provides less attractive temporal arbitrage for risk-averse and risk-neutral traders. Only those traders who are risk-loving could engage in temporal arbitrage and benefit from windfalls. Therefore, there is insufficient evidence that there is opportunistic

temporal arbitrage and that intertemporal trade is inefficient. In general, since the rate of return on speculative storage is modest, we believe that intertemporal trade appears to be competitive and optimal.

### **Conclusion and policy implications**

In an attempt to identify price stabilization strategies and rationalize public intervention in commodity markets, this paper analyzes the presence of price thresholds and their effect on commodity price volatility. Theoretical arguments attribute the presence of thresholds to speculative storage. This prediction was tested using threshold models. The result reveals the following findings. 1) There exists strong nonlinearity in Ethiopian grain price dynamics and threshold effects, which may be linked to speculative storage. Price thresholds appear to be an important aspect of price dynamics. 2) Such speculative storage causes strong price autocorrelation, which is larger than unity, but the effect on the variability of price spikes caused by shocks is not statistically significant. 3) The temporal arbitrage (expectation formation) appears to be rational and efficient. We found that the gross margin rate on intertemporal trade is not very different from the cost of storage. This implies that hoarding (deriving monopolistic profits through hoarding grain) was not a money-spinning business, at least during the study periods. Private grain traders had very limited power to destabilize the market and generate risk-free opportunistic profits.

The major implication that arises from the analysis is that speculative behavior is an important determinant of Ethiopian grain price formation. It leads to temporal market integration in the long run, with temporary breaks to adjust for critical thresholds. Therefore, speculative behavior has to be presumed while price stabilization policies are

formulated and implemented. The effect of any policy intervention made today will last longer in the presence of speculative trade. For example, it is possible that government interventions during harvesting time may be transferred beyond the harvest period by disrupting traders' expectation formation. The huge government-sponsored cooperatives' grain purchase during the 2006 harvest created unusual increases in the harvest time price, and that shock may have been carried through to the overall market via traders' expectations. Therefore, the current food price inflation could be aggravated by inappropriate interventions that assume speculative storage to be either ineffective or inefficient.

Should policy-makers ban or control speculative storage? In most developing countries, including Ethiopia, policy makers attempt to control private speculative storage, on the assumption that private speculators disrupt the market through stockpiling, which is driven by their expectation that the price will increase in the future even if the current price is sufficient to cover storage costs. As the intertemporal price formation is in line with the prediction of rational expectations and the temporal arbitrage is competitive, there are little grounds for designing antispeculative storage measures. A rising food price is likely to relate to supply shortfalls rather than to speculators' stockpiling, unless an increasing price carries information that predicts a further increase in price. However, we did not find that to be the case, at least during our study periods. Moreover, antispeculative storage measures instead create opportunism and intertemporal dissociation of supply, which further aggravates price volatility. As a result, we recommend that the government encourage intertemporal private trade to be more competitive. A reduction in storage costs, specifically storage loss and

transaction costs, may increase the efficiency of intertemporal trade and reduce any potential price explosion. A lower-cost public intervention could focus on formalizing the grain trade so that speculators become effective and more efficient. The recent initiation of a commodity exchange program is an example of this kind of intervention, which assists speculators to actively engage in speculative storage and future trading.

Although the paper generates plausible baseline information, we recognize that reliance on retail prices alone may limit its wider generalization and, hence, the implications presented above have to be interpreted cautiously. To improve the analysis, it will be helpful to include detailed data on stocks. The paper uses price data up to 2006. Price trends have dramatically changed since then, and the speculative behavior and its effect on price dynamics might have changed as well. Thus, the methods and arguments developed here can be used to provide updated empirical evidence using recent data sets and to provide timely information for policy makers.

## References

- Amha, W., and E. Gabre-Madhin (2005) Structure and conduct of grain marketing in Ethiopia ed. J. Pender, et al. Addis Ababa, IFPRI.
- Bekele, G. (2002) The Role of the Ethiopian Grain Trade Enterprise in Price Policy, ed. T. Bongor, E. Gabre-Madhin, and S. Babu. Addis Ababa, Ethiopia IFPRI.
- Chambers, M. J., and R. E. Bailey. "A theory of commodity price fluctuations." *Journal of Political Economy* 104, no. 5(1996): 924-957.
- Chavas, J. P., P. M. Despins, and T. R. Fortenbery. "Inventory dynamics under transaction costs." *American Journal of Agricultural Economics* 82, no. 2(2000): 260-273.
- Dadi, L., A. Negassa, and S. Franzel. "Marketing maize and tef in western Ethiopia: Implications for policies following market liberalization." *Food policy* 17, no. 3(1992): 201-213.



- Deaton, A., and G. Laroque. "Competitive storage and commodity price dynamics." *Journal of Political Economy* 104, no. 5(1996): 896-923.
- Deaton, A., and G. Laroque. "On the Behavior of Commodity Prices." *Review of Economic Studies* 59, no. 1(1992): 1-23.
- Dessalegn, G., T. S. Jayne, and J. D. Shaffer (1998) Market Structure, Conduct, and Performance: Constraints on Performance of Ethiopian Grain Markets. Addis Ababa, Ministry of Economic Development and Cooperation.
- Gabre-Madhin, E., and W. Amha (2005) Characterizing Grain Traders. Addis Ababa, Ethiopia
- Getnet, K. "Spatial Equilibrium of Wheat Markets in Ethiopia." *African Development Review* 19, no. 2(2007): 281-303.
- Getnet, K., W. Verbeke, and J. Viaene. "Modeling spatial price transmission in the grain markets of Ethiopia with an application of ARDL approach to white teff " *Agricultural Economics* 33(2005): 491-502.
- Greene, W. H. *Econometric Analysis* 5ed. New Jersey: Prentice Hall 2003.
- Gujarati, D. N. *Basic Econometrics* New York McGraw-Hill 2003.
- Gustafson, R. L. " Carry-over Levels for Grain: A Method for Determining Amounts That are Optimal Under Specified Conditions." *Technical Bulletin U.S. Department of Agriculture, Washington, D.C.*, no. 1178(1958).
- Hamilton, J. D. *Time Series Analysis*. New Jersey Princeton University Press, 1994.
- Loening, J. L., D. Durevall, and Y. A. Birru. "Inflation Dynamics and Food Prices in an Agricultural Economy: The Case of Ethiopia."
- MoARD. "Report on Price Stabilization Strategies." Ministry of Agriculture and Rural Development, Ethiopia
- Negassa, A. *Vertical and Spatial Integration of Grain Markets in Ethiopia: Implication for Grain Market and Food Security Policies* Addis Ababa Ministry of Economic Development and Cooperation, Ethiopia 1998.
- Negassa, A., R. Myers, and E. Gabre-Madhin. "Grain Marketing Policy Changes and Spatial Efficiency of Maize and Wheat Markets in Ethiopia ". International Food Policy Research Institute.

- Newbery, D. M. G., and J. E. Stieglitz. *The Theory of Commodity Price Stabilization: A Study in the Economics of Risk*. New York: : Oxford University Press, 1981.
- Osborne, T. "Market news in commodity price theory: Application to the Ethiopian grain market." *Review of Economic Studies* 71, no. 1(2004): 133-164.
- Sadoulet, E., and A. deJanvry. *Quantitative Development Policy Analysis* The Johns Hopkins University Press 1995.
- Sahn, D. E., and C. Delgado (1989) *The Nature and Implications for Market Interventions of Seasonal Food Price Variability* ed. D. Sahn. Baltimore, Johns Hopkins University Press.
- Scheinkman, J. A., and J. Schechtman. "A Simple Competitive Model with Production and Storage." *Review of Economic Studies* 50, no. 3(1983): 427-441.
- Shively, G. E. "Price Thresholds, Price Volatility and the Private Costs of Investment in a Developing Country Grain Market. ." *Economic Modelling* 18, no. 3(2001): 399-414.
- Tsay, R. S. "Modeling nonlinearity in univariate time series analysis." *Statistical Sinica* 1, no. 43(1991): 1-452.
- Tsay, R. S. "Testing and modeling threshold autoregressive processes." *Journal of the American Statistical Association* 84, no. 23(1989): 1-240.
- Williams, J. C., and B. D. Wright. *Storage and Commodity Markets*: Cambridge Cambridge University Press, 1991.
- Wright, B. (2001) *Storage and Price Stabilization* ed. B. L. Gardner, and G. C. Rausser, vol. 1B. North-Holland, Elsevier.
- Wright, B. D., and J. C. Williams. "The Economic Role of Commodity Storage." *The Economic Journal* 92, no. 367(1982): 596-614.

**Table 1. Threshold nonlinearity tests for the Ethiopian commodity prices**

<i>Tests</i>	<i>Teff</i>	<i>Maize</i>
Tsay_GNL_F test	3.19***	2.67**
Tsay TAR_F test	5.63**	5.87**
Hansen test	1.57**	0.9318*
CUSUMQ test	0.43	0.51

The CUSUMQ test values are the mean of the cumulative sum of squared residuals.

**Table 2. Threshold prices and storage estimated using switching maximum likelihood**

<i>Parameters</i>	<i>CTAR</i>		<i>PTAR</i>	
	<i>Teff</i>	<i>Maize</i>	<i>Teff</i>	<i>Maize</i>
p <sup>1</sup>			2780 (8)	1270 (12)
p <sup>2</sup>	2940 (12)	1360 (15)	2980 (12)	1370(11)
Stock-out rate	0.11	0.19	0.14	0.24
LR test against AR	3.10***	10.64***	27.54***	10.96***

CTAR = Constant Threshold Autoregression, PTAR= Periodic Threshold Autoregression

P<sup>1</sup>=harvesting season threshold, P<sup>2</sup> = non-harvesting season threshold

Numbers in the parentheses are percentage changes of the threshold prices from the long term average price

Table 3. Results of the switching maximum likelihood estimation of threshold models

Parameters	AR		CTAR		PTAR		Change
	Above threshold*	Below threshold*	Above threshold*	Below threshold*	Above threshold*	Below threshold*	
Autocorrelation coefficient ( $\gamma$ )							
Teff	0.999 (0.004)	0.982 (0.009)	1.002 (0.0053)	1.004	0.957 (0.0089)	1.004 (0.0051)	0.05***
Maize	0.997 (0.0074)	0.9531 (0.0238)	1.011 (0.0125)	0.960 (0.0197)	0.960 (0.0197)	1.014 (0.0135)	0.05***
Variance ( $\sigma$ )							
Teff	11.753 (0.7404)	9.357 (1.9271)	9.303 (0.9282)	10.176 (1.8476)	8.773 (0.9077)	1.403	
Maize	9.953 (0.627)	12.323 (2.470)	9.218 (1.009)	11.4686 (1.979)	9.265 (1.0777)	-2.2*	
Rate of gross margin (%)							
Teff		2.4		5.5			
Maize		13.4		16.6			

\*Numbers in parentheses are standard errors of the estimates.<sup>3</sup> A zero intercept restriction was imposed in all models to satisfy the arbitrage conditions.

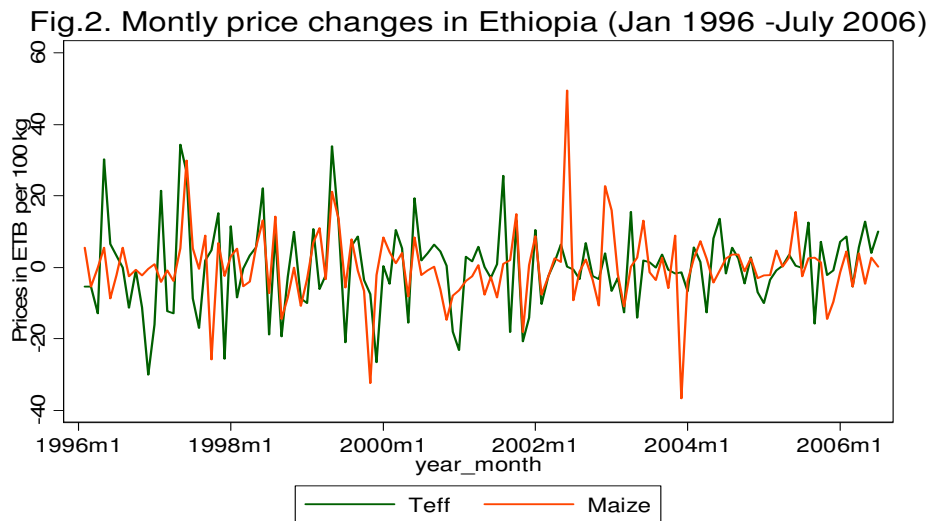
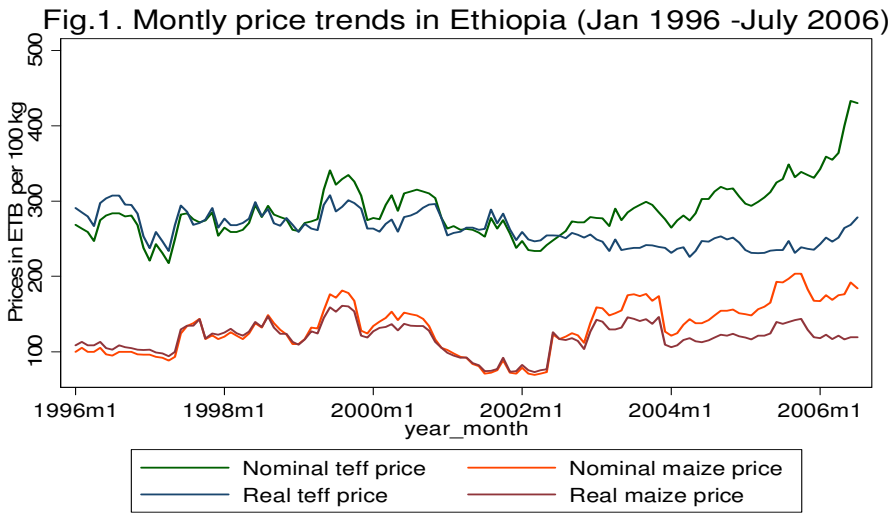
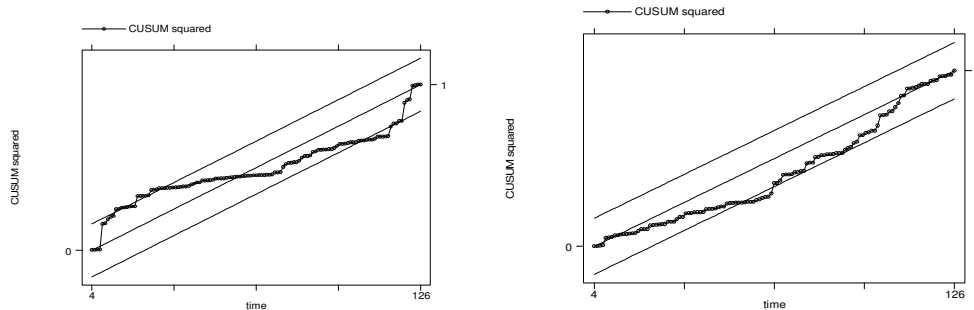


Fig. 3. CUSUM squares from recursive regressions of commodity prices





# Paper III





## Interlinked Contracts and Smallholders' Commercialization: Evidence from Southern Ethiopia

Getaw Tadesse\* and Atle Guttormsen

Department of Economics and Resource Management,

Norwegian university of Life Sciences

P.O.Box 5003; 1432 Ås; Norway

E-mail: [getaw.gebreyohanes@umb.no](mailto:getaw.gebreyohanes@umb.no)

[atle.guttormsen@umb.no](mailto:atle.guttormsen@umb.no)

**Abstract:** *Smallholders who strive to transform from subsistence to commercialization, face many challenges that ranges from the inevitable natural disasters to unexpected institutional hurdles. This paper investigates the prospects and challenges of commercializing smallholders through formal and informal interlinked contracts. The role of these contracts in accessing credit and hedging risk thereby enhancing commercialization is assessed. Multinomial and switching regressions are used to estimate market choice and the extent of commercialization on a household survey data collected in 2006 from the central rift valley of Ethiopia. The result reveals that smallholders' market choice appears to depend on risk and information access but not on marketing costs. The extent of commercialization is significantly influenced by bargaining power and discretionary incentives. Controlling resource endowments, the comparison of mean marketed surplus under different interlinked markets revealed that relational (informal) contract impacts commercialization better than cooperative (formal) contract. Based on the theoretical and empirical evidences we argue that the role of interlinked contracts is undermined by the presence of skewed bargaining power in relational contract and non-discretionary pricing problem in cooperative contract. However, the non-discretionary effect is stronger than the bargaining power effect. The major implication of the findings is that interlinked contracts have to be reorganized in order to capitalize their benefits to smallholders.*

*JEL: O13; Q13; L14*

*Key words: interlinked transactions, relational contracts, cooperatives, discretionary incentive, bargaining power, commercialization, Ethiopia*

---

\* Permanent address: Hawasa University, P.O.Box 05, Hawassa, Ethiopia. [getawtadesse@yahoo.com](mailto:getawtadesse@yahoo.com)

## **Introduction**

Economists have long advocated commercialization<sup>1</sup> as part of a broader strategy of comparative advantage. The underlying premise is that markets allow households to increase their incomes by producing that which provides the highest returns to land and labor, and then use the cash to buy household consumption items, rather than be constrained to produce all the various goods that the household needs to consume (Pingali, 1997, Timmer, 1997). While this concept of comparative advantage is well accepted under the assumption of well functioning markets, the process of commercialization involving cash crops is impeded by risks and high transaction costs in the marketing system. In an environment where risks and transaction costs are excessive, smallholders prefer to be self-sufficient and produce for subsistence rather than producing a product on which they have comparative advantage.

As a way to tackle these impediments, interlinked contracts are being widely advocated (WDR, 2008). Interlinked contracts that tie credit (in-cash or in-kind) to the delivery of product at harvest have many incentives and constraints they can offer for smallholder farmers. Since interlinked contracts involve transactions of inputs and outputs, in areas of imperfect market, they are important means of accessing credits, inputs and stable market outlets (Key and Runsten, 1999, Masakure and Henson, 2005, Sartoriusa and Kirsten, 2005, Simmons, et al., 2005). Interlinked contracts can help to share risks among contracting parties. Prices or price formulas usually determine before planting so that both producers and buyers will be guaranteed. Depending on the type of contracts, interlinked contracts

---

<sup>1</sup> Commercialization may refer to the process which involves a transformation from production for household subsistence to production for markets. It may be measured by the proportion of production supplied to markets or the proportion of cash crop produced relative to total production or total crop area. The latter measurement is used to ascertain that producers are not selling what is leftover but they are purposely producing for market.

can also provide discretionary incentive<sup>2</sup> to smallholders. Relational contracts, for example, lay good ground to implement discretionary incentive(Wu and Roe, 2007). The buyer in relational contracts has the capacity to provide bonus in the form of discretionary price to enforce higher quality grain where formal grading system is absent. These provisions and incentives may encourage farmers to reorient their production towards a commodity of comparative advantage.

However, interlinked contracts reduce the bargaining power of smallholders (Little and Watts, 1994, Porter and Philips-Howard, 1997). This is because; first, individual farmer's supply is very small so that each farmer has very little power to threaten the buyer through termination of contract. Second, most contracts are done in conjunction with credit provision and risk minimization that limits the exit option of capital constrained and risk averse farmers. Third, farmers may make special investment for the commodity under contract and hence shifting to other commodity production is costly. When the principal (buyer) owns the highest bargaining power in a contract, agents (farmers) will be forced to receive a reduced price. This will lead agents to refrain from producing for markets. To conceal this problem, interlinked contracts are being organized through farmers' cooperatives (Sexton, 1986). Cooperatives, unlike individual farmers, can easily get access to credits from formal financial markets and provide this credit to members with the same interest rate. Farmers' agreement to supply grain at harvest is used as collateral. Thus, farmers will have the power to influence the price setting mechanism. The buyer in the cooperative contract, however, adopts non-discretionary pricing system in which the same

---

<sup>2</sup> Discretionary incentive is a term widely used in relational contract literatures. It refers to a subjective incentive or bonus paid to the agent depending on the buyer's discretion. In agricultural market, it refers to an additional payment for grain suppliers based on the traders' subjective assessment of grain quality and quantity

price is paid to all members irrespective of growers' and products' type. This is because monitoring the action of an agent delegated to collect grain from farmers (which is the double delegation problem) under flexible and discretionary system is very costly. Buyers in cooperative contract lack the experience as well as the incentive to form a price that is incentive compatible. These conditions affect producers' strategic choice of market outlets and extent of market participation.

In this paper, we examine the relative impacts of the bargaining power and discretionary incentive on smallholder's production and marketing decision. We develop theoretical models that can show how bargaining power and discretionary incentive can affect the price received by smallholders. We test the hypothesis that unless interlinked contracts are flexible enough to create discretionary incentive, creating bargaining power alone will not attract smallholders to engage on market-oriented production. When uniform price is set to all agents irrespective of the product quality and quantity, they will lack the necessary incentive to exert higher effort on improving quality or quantity of the product.

The empirical test is based on comparison of relational and cooperative contracts in haricot bean markets in Ethiopia. Relational contracts are agreements between smallholder farmers, and local grain traders and seed companies. Local traders lend money to smallholders during wet seasons when farmers are out of stock. Farmers usually pay in-kind during harvest. The money can be used either for consumption or production depending on the specific purpose of the transaction. In this contract, transacting parties have no formally written agreements except their social relations to enforce agreements. Cooperative contracts are agreements between farmers and farmers' cooperative organizations. In Ethiopia, cooperatives are organized by "market-oriented agricultural production" and "linking farmers to markets" approaches recognized by the government and some non-

governmental organizations. The approaches aim to transform subsistence production to market oriented production through interlinking access to inputs, technologies and output markets (FDRE, 2005). With the advent of this approach, cooperatives are expanded to include wheat, barley, spices, soybean, haricot bean, chickpea, tomato, and dairy products. Haricot bean cooperative markets are performing better than the others.

The rest of the paper is organized as follows. The second section explains the theoretical foundation that draws hypotheses for empirical test. Section three presents the empirical estimation methods used to compare the different markets. A multinomial-switching regression is adopted to analyze the effects of alternative interlinked contracts on commercialization. The fourth section describes the data set and the study areas. The results and discussions are presented in section five. In this section we explain determinants of smallholders' participation in different contracts and variations in the level of commercialization. The findings are discussed in line with the ongoing debate on strategic choice of linking producers to markets. The last section presents concluding remarks and few policy implications.

### **Theoretical framework**

Interlinked contracts affect commercialization through reducing transaction cost, minimizing price risks (Key and Runsten, 1999, Little and Watts, 1994, Masakure and Henson, 2005, Sartoriusa and Kirsten, 2005, Silva, 2005, Simmons, et al., 2005), empowering bargaining power (Bernard, et al., 2007, Holloway, et al., 2000) and providing discretionary incentive (Hviid, 1998, Wu and Roe, 2007). Within the Ethiopian haricot bean market context, all these effects are ascribed through price effect. Thus, our theoretical presentation, first, describes how price is formed in spot, relational and cooperative

contracts and then analyzes smallholders' commercialization decision given prices from each market.

### *Pricing in interlinked markets*

Haricot bean spot price (a price in a market without any interlinked transaction) exhibits extreme volatility over years and months. Apart from the natural aggregate supply fluctuation, the volatility is partly explained by the partial integration of the local market to the world market. Because of this partial integration the domestic market has two equilibriums that yield different outcomes for growers and marketers alike. Fig.1. is used to explain this claim. As we see from the figure, prices are formed based on local demand, the efficiency of the export sector and the world price. The effective demand function is different below and above an aggregate level of supply,  $R_s^0$ , above which export marketing is profitable and below which export is not profitable due to economies of scale in the export sector. When  $R_s < R_s^0$ , the average cost is above the world price, making export less profitable so that the market demand comprises only domestic demand. The equilibrium price holds at  $p_s^L$ . If the minimum supply holds at  $R_s^0$ , the market will enjoy the derived demand from world market. The local price increases to  $p_s^*$ , where it corresponds with the intersection of the exporters marginal cost and the world price.

The expected price received by a producer who engages neither in cooperative nor in relational contract is:

$$P_s^e = \frac{P_s^L + P_s^*}{2} \quad (1)$$

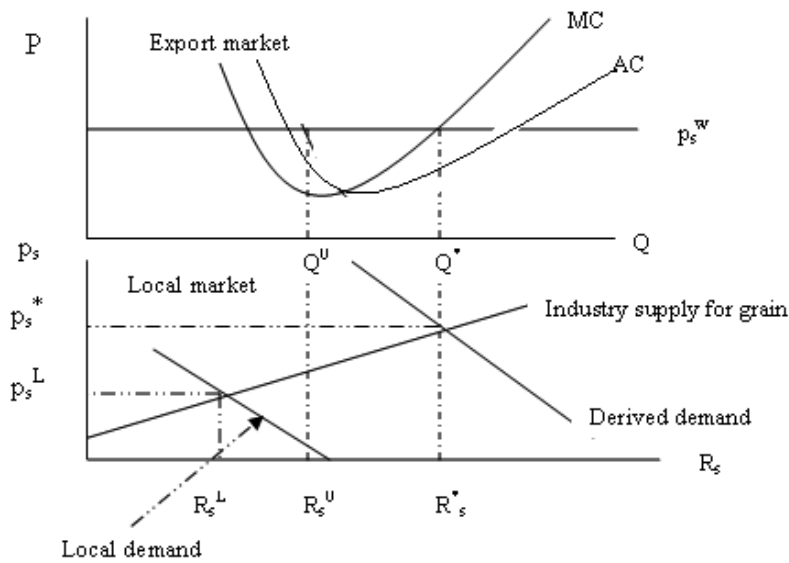


Fig1. Haricot bean pricing in Ethiopia

When a producer participates in interlinked contract, the price formation process greatly differs. Principal-agent framework is used to determine the equilibrium price in interlinked contract, where the buyers (traders/seed firms) are represented as principal and the sellers (farmers) as agents. The principal plays as a single buyer but it takes in to account price signal from the spot market while setting the contract price. The principal also discriminates price depending on the seller's type assuming that the seller's type in terms of risk aversion and resource endowment is known to the buyer because of frequent and informal relation between the buyer and the seller. In this market, the buyer owns a higher bargaining power than the seller and hence the principal is modeled as a Stackelberg leader who offers a take-it-or-leave it contract which the agent must either accept or reject. Such relationship is represented as a sequential game where the principal decides first and the agent moves next(Laffont and Martimort, 2002). The benefit of contracting for the buyer is securing maximum grain supply at a cost close to the sellers' reservation price. The buyer

will achieve these benefits through setting a contract price to each seller conditional to its reservation. To show how it works, let us assume the principal's production<sup>3</sup> is represented by a fixed proportion of production function as

$$Q = \alpha R \quad (2)$$

where  $Q$  is the final product supplied to the world market,  $R$  is the primary grain collected from farmers and  $\alpha$  is the conversion factor of  $R$  to  $Q$  and its value ranges from zero to one depending on the quality of  $R$ . The higher the quality will be closer to one. We further assume the principal's cost function of transforming  $R$  to  $Q$ ,  $M$ , is decreasing return to scale with respect to  $R$  to signify economies of scale in grain marketing and inversely related to the conversion factor to show lower quality grain costs more labour and material for cleaning<sup>4</sup>.

$$M = M(R, \alpha) \quad (3)$$

We assume credit market is either missing or imperfect in the study area. Farmers can get credit only from their buyer through interlinked transaction. The buyer, however, limits the amount of credit contingent upon the supply of primary product, that is,

$$k = \lambda(p_c s_c + p_o s_o) \quad (4)$$

where  $s_i$  is part of the total quantity of grain ( $q$ ) the agent supply for market  $i$ ,  $p_i$  is net grain producer price after interest rate at market  $i$ ,  $i = s, c, o$ , the subscript  $s$  stands for spot market,  $c$  for relational contract and  $o$  cooperative contract.  $\lambda \in [0, 1]$  is the proportion of total value of supply that the buyer is willing to lend and the seller is willing to

---

<sup>3</sup> It includes cleaning, processing and packing of the primary grain obtained from the farmers before it is supplied to the international market

<sup>4</sup> Empirical observation in our study area show that exporters cost highly related to how pure is grain from external materials and how the bean is timely harvested. Hundreds of labors are hired to clean the seed every day.



borrow. The seller demand depends on owned capital,  $k_0$ . The higher the owned capital, the lower will be the demand for credit and so the proportion. When  $s_c = s_0 = 0$ ,  $k = k_0$ . Equation (4) makes production and marketing decisions non-separable.

Given these assumptions, a risk neutral principal maximizes the following expected profit to set a contract price for the  $j^{th}$  agent

$$Max_{\{p_c\}} \pi = P\alpha_c R_c - p_c s_c - p_s^e (R_c - s_c) + (i - r)k - M_c(R_c, \alpha_c) \quad (5)$$

where  $R_c$  denotes the total grain demand of the principal,  $r$  represents the opportunity cost of capital out-funded for the farmers, which could be equal to the formal financial market interest rate if the principal has full access to these markets,  $i$  represents the interest rate charged from farmers,  $P$  the whole sale price received by the trader derived from the world market.

The first order condition of (5) gives us equilibrium contract price for the  $j^{th}$  agent

$$p_c = \frac{P\alpha_c - MR_c - S_c/e}{1 + \lambda(i - r)} \quad (6)$$

where  $e = \partial s_c / \partial p_c > 0$  is the farmers supply response to price change. Its magnitude is obtained from the response function of individual farmer (12).  $M_{R_c}$  is the trader's marginal cost. The contract price depends up on farmer's response to price change ( $e$ ), world price, the conversion factor, bank's interest rate and the marginal cost of processing grains. Except banks interest rate, marginal cost and whole sale price, all other parameters are endogenous to individual farmer. Since  $e$  depends on individual seller characteristic, discriminatory contract price will be made to each participating farmer. A responsive farmer receives better price than less responsive farmer.

The pricing mechanism will be different when producers sell their products through cooperative. The purpose of organizing cooperatives is to solve bargaining power inequality between buyer and seller, and reduce marketing cost through economies of scale (Sexton, 1986). Unlike individual contract, two prices have to be determined in cooperative contract- a contract between a farmer and a cooperative. These are the selling price to the principal (exporter) and the buying price to members (farmers). Since the cooperative has better bargaining power, the selling price will likely be higher than the average price received by farmers if they sell individually. However, the buying price will not be incentive compatible. The cooperative management usually sets uniform (non-discretionary) buying price applicable to all farmers. This is because monitoring the action of an agent delegated to collect grain from farmers (which is the double delegation problem) under flexible and discretionary system is very costly. Buyers in cooperative contract lack the experience (typically for Ethiopian case) as well as the incentive to form a price that is incentive compatible. Thus, the same per unit price is paid to all farmers irrespective of quantity and quality. This feature is common to formal contracts (Bolton and Dewatripont, 2005) and most agricultural cooperative marketing where grading and standardization is not well developed (Akwabi-Ameyaw, 1997). In order to set this uniform price, the cooperative (principal) optimizes the total profit by choosing the total quantity of grain collected from members instead of choosing the contract price. The problem is expressed as

$$\max_{\{R_o\}} E(\pi_o) = P\alpha_o R_o - p_o R_o - rk(R_o) - M_o(R_o, \alpha_o) \quad (7)$$

All the symbols imply similar variables as in equation(5), except that the subscript  $o$  denotes cooperative contract. Since the cooperative borrow money from banks to give

service for members without any top up payment, farmers pay an interest rate equals to bank's interest rate.

The first order condition of (7) gives us the inverse demand function of the cooperative organization

$$p_o = \alpha_o P - M_{R_o}(R_o, \alpha_o) \quad (8)$$

where  $M_{R_o}$  is the marginal cost of the cooperative for processing and marketing a unit of grain. Unlike the contract case, all participants receive the same, exogenous and competitive price determined based on world price, the average conversion factor and the marginal cost of marketing. A properly organized cooperative formation avoids imperfections and makes price exogenous. But this uniform price is inflexible to quality and quantity due to the hidden action problem discussed above.

#### *Smallholders' marketing decision*

Given the prices in each market (equation 1, 6, 8), a rational producer decides where and how much to sell to each markets. Marketing decision is made prior to production decision due to pre-harvest agreement to borrow money for input purchase. Suppose farm level production is represented as:

$$q = q(k, A, L), \quad q'(k) = q_k > 0, \quad q''(k) = q_{kk} < 0 \quad (9)$$

where  $q(\cdot)$  is twice differential farm level production function, expressed as a function of capital,  $k$ , and other inputs like labor,  $L$ . To make the analysis simple, let the farm level marketing cost,  $m$ , linearly related to the size of grain supplied in each market, i.e,

$$m = \sum \eta_i s_i \quad (10)$$

where  $m(\cdot)$  is farm level marketing costs including transportation, searching potential buyers, and malpractices.  $\eta_i$  is unit cost of marketing at market  $i$ .

The agent faces certain price in interlinked markets and stochastic price in spot market that is derived either from the domestic market or from the world market depending on the size of the market. These possibilities are built in the model through pre-determined relational contract market price,  $p_c$  cooperative contract price,  $p_o$ , and stochastic spot price  $p_s$  distributed with mean  $p_s^e$  and variance  $\sigma^2$ . Given these prices, the agent maximizes expected utility of income ( $y$ ) to decide how much to supply to each market,  $q_i$ . Following (Andersson, 1995, Sadoulet and Janvry, 1995), a risk-averse agent maximize expected utility as

$$\text{Max}_{\{s_i\}} E(u(y)) = u(p_s^e s_s + p_c s_c + p_o s_o - \eta_s s_s - \eta_c s_c - \eta_o s_o) - \frac{\psi}{2} \sigma^2 s_s^2 \quad (11)$$

$$\text{Subject to } s_s = q - s_c - s_o \quad (12)$$

where  $\psi$  denotes the absolute risk aversion of the agent, The first-order necessary conditions of maximizing (11) with respect to  $s_i$  are

$$s_c : p_c + q_k \lambda p_c^2 + (\eta_s - \eta_c) + \psi \sigma^2 s_s - p_s^e - \eta_c q_k \lambda P_c = 0 \quad (13)$$

$$s_o : p_o + q_k \lambda p_o^2 + (\eta_s - \eta_o) + \psi \sigma^2 s_s - p_s^e - \eta_o q_k \lambda P_o = 0 \quad (14)$$

where  $q_k$  is the marginal productivity of borrowed capital. Equations (13) and (14) construct the optimality condition for efficient allocation of farmer's output to the different markets. At equilibrium, the marginal costs and the marginal benefits of a unit supply to each market have to be the same. The marginal cost consists of the forgone spot market marginal revenue ( $p_e$ ), and an additional marketing cost incurred for increased produce due to access for capital. The marginal benefit consists of four terms; the marginal revenue of a

unit supply of grain to each market, the marginal values of additional capital, the gain from a reduction in marketing cost and the risk premium obtained due to shifting a unit of grain from risky to less risky market. The two equations basically differ in terms of decision prices and per unit marketing/transaction costs. The optimal supply to the  $i^{th}$  market is generalized by the following explicit function:

$$s_i^* = f_i(p_i^*, p_h^*, \eta_i, \eta_h, \psi, \sigma^2, k_0, \lambda, ) \quad i \neq h \in (s, c, o) \quad (15)$$

#### *Theoretical preposition*

**Preposition1:** Risk aversion and cash constraint causes farmers to participate and supply more grains in interlinked markets than spot markets. However, due to bargaining problem in grain pricing, the effects of risk aversion and cash constraint in relational contract is lower than in cooperative contract.

The proof of this preposition follows comparative statistics for a change in risk aversion and cash constraint in each market:

#### *Risk aversion behavior*

$$\frac{\partial s_c}{\partial \varphi} = \frac{\partial s_c}{\partial \varphi} \Big|_{p_c=cons} + \frac{\partial s_c}{\partial p_c} \cdot \frac{\partial p_c}{\partial \varphi} = \frac{-\sigma^2 s_s}{D_c} + \frac{s_c}{e(\lambda r + 1)} \cdot \frac{\partial e}{\partial \varphi} = (+) + (-)??^5 \quad (16)$$

where  $D_i = (q_{kk} - \eta_i)\lambda^2 p_i^3 + \psi\sigma^2(q_k \lambda p_i - 1) < 0$ , Since price in relational contract depends on the individual's risk behavior, risk aversion will have supply effect and price (bargaining) effect. So long as production function is concave(9), the supply effect is always positive because the more risk-averse seller supply more grains to contract market where risk is lower. The bargaining effect is a product of the buyer's responsiveness to the sellers' price,

$$^5 e = \frac{-(1 + q_k \lambda (2p_c - \eta_c))}{D_c}$$

which is positive and the sellers' responsiveness to risk, which is negative. In general, the bargaining effect is always negative implying more risk-averse farmer receives reduced price and prefers not to participate in relations contract. If they participate, they will supply very low grain. As a result, the effect of risk behavior on market choice and extent of commercialization depends up on the magnitude of the bargaining effect.

$$\frac{\partial s_o}{\partial \varphi} = \frac{\partial s_o}{\partial \varphi} \Big|_{p_c = cons} + \frac{\partial s_o}{\partial p_o} \cdot \frac{\partial p_o}{\partial \varphi} = \frac{-\sigma^2 s_s}{D_o} \geq 0 \quad (17)$$

In cooperative market the individuals risk behavior has no effect on pricing. Thus, only supply effect will guide the seller's decision. Provided that the farmers' production function is concave, a more risk-averse farmer prefers to supply his grain to cooperative market to hedge price risks.

*Liquidity constraint:*

When credit market is imperfect, production depends on the level of owned liquid capital. The more endowed farmer needs less external capital, while those who are liquidity constrained farmers need to borrow higher proportion of advance payment, i.e,  $\frac{\partial \lambda}{\partial k_0} < 0$

$$\frac{\partial s_c}{\partial k_0} = \frac{\partial s_c}{\partial \lambda} \cdot \frac{\partial \lambda}{\partial k_0} \Big|_{p_c = cons} + \frac{\partial s_c}{\partial p_c} \cdot \frac{\partial p_c}{\partial \lambda} \cdot \frac{\partial \lambda}{\partial k_0} = \frac{-q_k p_c (p_c - \eta_c)}{D_c} \frac{\partial \lambda}{\partial k_0} + \frac{s_c}{e(\lambda r + 1)} \frac{\partial e}{\partial \lambda} \frac{\partial \lambda}{\partial k_0} = ?? \quad (18)$$

Since  $\frac{\partial e}{\partial \lambda} < 0$  the last term in (18) is unambiguously positive that demonstrates the positive effect of cash availability on producer's price. Those farmers who are liquidity constrained receive unfavorable price and the positive effect of cash constraint on choosing contract will be undermined by the negative effect of the unfavorable price. Cash

availability may increase commercialization in contract market if the bargaining effect is higher than the production effect.

$$\frac{\partial s_o}{\partial k_0} = \frac{\partial s_o}{\partial \lambda} \cdot \frac{\partial \lambda}{\partial k_0} = \frac{-q_k p_o (p_o - \eta_o)}{D_0} \frac{\partial \lambda}{\partial k_0} \leq 0 \quad (19)$$

A reduction in  $k_0$  increases  $s_o$  implying cash constraint unambiguously encourages farmers to join cooperative market where their capital demand does not derive the price received down. The effect of cash constraint, however, will disappear once producers join cooperative where cash is easily be accessible.

**Proposition 2:** Those farmers who produce quality or more quantity grain prefer to engage in relational contract than in cooperative contract as a result of uniform price that does not create discretionary incentive to enforce higher efforts.

The proof of this statement depends on the assumption that quality of grain is related to labor endowment where more labor endowed farmers tend to produce high quality grain<sup>6</sup>. Here we show how labor endowment affects market choice.

$$\frac{\partial s_i}{\partial L} = \frac{\partial s_i}{\partial q} \cdot \frac{\partial q}{\partial L} + \frac{\partial s_i}{\partial p_i} \cdot \frac{\partial p_i}{\partial \alpha} \frac{\partial \alpha}{\partial L} = q_L + e(p - \frac{\partial M_{R_c}}{\partial \alpha_c}) > 0 \quad (20)$$

Since  $\frac{\partial M_R}{\partial \alpha} < 0$ , both the production ( $q_L$ ) and price  $e(p - \frac{\partial M_R}{\partial \alpha})$  effects are positive. The production effect implied that more endowed farmers produce more grain and supply more grain to any of the markets. The price effect is observable if price is contingent up on

---

<sup>6</sup> The assumption is not unrealistic if one looks at it from the study area context. In the study area we found that quality of bean grain is related to frequency of weeding and timely harvesting. Late harvesting causes the seed to shatter while early harvesting causes seeds to shrink and lose their natural color. In an environment labor market is thin, frequency of weeding and timely harvesting depends on household's labor endowment.

quality or quantity of grain. This is typically true in contract sometimes in spot markets due to discretionary pricing. More labor endowed farmers receive better price and supply more grains. Both the production and price effects are positive and hence the total effect is unambiguously positive.

The second term in (20) is zero in cooperative market as a result of non-discretionary pricing, that is;  $\frac{\partial p_o}{\partial \alpha_{oj}} = 0$ . Thus  $\frac{\partial s_c}{\partial L} > \frac{\partial s_o}{\partial L}$

### Estimation Methods

The decision where to sell involves more than two choices. Smallholders have at least three options that include spot, relational and cooperative markets. If there are  $m$  markets, then contract choice is modeled as

$$Y_i = x_i' \beta + u_i, \quad (21)$$

where  $Y$  takes a value of  $1, 2, \dots, m$ ,  $x$  a vector of explanatory variables that include both continuous and dummy variables,  $\beta$  vector of parameters to be estimated and  $u$  is a random error assumed to have zero mean and constant variance. Since the dependent variable is categorical and the categories are more than two, estimating (21) with OLS or simple binary models gives inconsistent estimates (Maddala, 1983). As a result, we used multinomial logit. The model assumes a logistic probability distribution for the error term and hence the market choice model (21) is rewritten as

$$P(Y_i = j) = \frac{\exp(x_i' \beta_j)}{1 + \sum_{k=1}^{m-1} \exp(x_i' \beta_k)} \quad (j = 1, 2, \dots, m-1) \quad (22)$$



where  $P$  is  $i^{th}$  individual probability of choosing  $j^{th}$  market. The standard multinomial-logit is a family of polycotomus logit models particularly applicable when attributes (explanatory variables) are individual specific rather than choice specific<sup>7</sup>, the multiple choices are made simultaneously, the odds ratio are independent of the irrelevant alternative (IIA) (Greene, 2003, Maddala, 1983). The IIA assumption is statistical and hence testable. Hausman and McFadden test is used to test the IIA assumption in multinomial logit(Hausman and McFadden, 1984). The test is based on the idea that if the model is true,  $\beta_j$  can be consistently estimated by multinomial logit by focusing on any subset of the alternatives.

The simultaneity assumption of multinomial models originates from the behavior of the agent's decision making. If respondents make choice consecutively, multinomial models would provide less incisive result. For example, if farmers choose markets sequentially in such a way that first they choose between spot and contract market and then between relational and cooperative contracts, then *sequential-logit* gives more incisive and robust estimation (Maddala, 1983). Sequential logit is a repeated binary logit when responses are made stepwise. To show how it works, suppose  $Y_i = 1$  If the  $i^{th}$  individual choose to sell his grain in interlinked markets,  $Y_i = 2$  if the  $i^{th}$  individual choose to sell his grain to cooperative market, then the probability of choice is such that

$$\begin{aligned} P_1 &= F(x' \beta_1) \\ P_2 &= F(x' \beta_2) \end{aligned} \tag{23}$$

The parameters  $\beta_1$  are estimated from the entire sample by dividing it into two: spot market and contract markets participants. The parameters  $\beta_2$  are estimated from the sub-

---

<sup>7</sup> If the attributes are choice specific, conditional logit is an appropriate procedure to estimate multiple choice problems

sample of farmers who sold their grain in interlinked contracts by dividing them into relational and cooperative participants. Sequential logit model enables us to identify different determinants of choice at different stages and it also eliminates the problem of IIA if the choice at each stage remains dichotomous. However, its validity depends on the independence of the random factors influencing responses at various stages.

Once contract choice is made, the next issue is how commercialization could be estimated. Commercialization is measured in terms of amount of haricot bean supplied to the market and proportion of area allocated to haricot bean. To measure the impacts of interlinked contracts on commercialization we used switching regression models. We assume interlinked contracts bring structural change on the supply response of farmers. The structural impact changes both the marginal and average value of commercialization. Since interlinked contracts are meant to minimize market imperfections and access resources, the overall structural relationship between resource endowments and market supply may generally break and leads to separability of household's decisions. Switching regression is commonly used for binary choices. Here we modified it to suit for multinomial choices. Thus, we estimated three separate regressions for spot, relational and cooperative markets. That is,

$$y_i = \beta_j' x_{ji} + u_{ji} \quad \text{iff} \quad \tau_j' Z_{ji} \geq u_i \quad (24)$$

Where  $j$  stands for spot, relational and cooperative markets or regimes,  $y_i$  is marketed surplus,  $x_i$  is a vector of exogenous regressors that include both continuous and discrete variables  $\tau_j' Z_{ji} \geq u_i$  is a criteria function that determine which of the three regimes is applicable. If  $u_{ji}$  and  $u_i$  are uncorrelated, the switching to each regime is

exogenous and hence the  $\beta$  parameters in equation (24) can be consistently estimated using OLS on the sub-samples of each markets.

Very often, farmers' select a market that best suits to their characteristics, which are not always observable so that  $u_{ji}$  and  $u_i$  are likely to be correlated. To check this, two-stage endogenous switching regression is employed. The estimation procedure for endogenous switching model with only two regimes is well documented (Maddala, 1983). Following similar reasoning, we present an estimation method for three regimes /markets. Unlike for two regime case, we shall define a dummy variable for each regime as

$$\begin{aligned} I_{ij} &= 1 \text{ if } \tau_j' Z_{ji} \geq u_i \\ I_{ij} &= 0 \text{ otherwise} \end{aligned} \quad (25)$$

Since the sample separation is observable, we generate three dummies one for each market and estimate the parameters  $\tau_j$  using probit model. Then we estimate three inverse mills

ratios as  $w_{ji} = \frac{\phi(\tau_j' Z_{ji})}{\Phi(\tau_j' Z_{ji})}$  and rewrite equation (24) as

$$y_i = \beta_j' x_{ji} + \alpha_j w_{ji} + e_{ji} \quad (26)$$

Similar to the Heckman's selection bias test, the significance of  $\alpha_j$  implies and controls the endogeneity of switching.  $e_{ji}$  is tested for possible heteroscedasticity and equation (26) is estimated separately for each market using sub-samples.

## The data

The data was collected from the central rift valley areas of Ethiopia where lowland pulses are widely grown for export. The study focuses on haricot bean for the simple reason that its marketing system constitutes different interlinked contractual arrangements. Haricot bean is considered as a cash crop and hence it is mainly produced for market as an export

commodity. It is a lucrative enterprise in the lowland areas where it can easily grow with very short rainy season at lower costs than other crops. As a result it covers more than 23 % of the total cultivated area in the central and southern parts of the rift valley. At national level, it generates considerable amount of foreign earnings. Together with other pulse crops, it shares about 6% of the total value of the country's foreign export earnings, which is higher than the export values of flower. Since 2004, pulse export value shows an annual growth of more than 90% percent (NBE, 2007). The spot market is characterized by high transaction cost and extreme price volatility. The annual and monthly price variability<sup>8</sup> reaches as large as 44% and 85% respectively.

Of the vast central rift valleys, we chose Digdabora (Meki) woreda (district) from Oromia region and Borcha woreda from Southern Nations, Nationalities and Peoples (SNNP) region to collect farm level data. Meki and Borcha are located about 110 and 300 km south of Addis Ababa respectively. Meki has relatively good access for markets. It lies on the high way that runs from Addis Ababa to Moyale. It has also very plain topography and fertile soils that best suit for cultivation. Some few farmers have access to irrigation. However, the *woreda* is typical dryland and has very short rainy season. The major crops grown here include maize, teff and haricot bean on rain fed lands and tomato and onion on irrigated lands. *Borcha* is one of the dry and food insecure areas of SNNP. Its topography is highly undulated. Access to markets is relatively poor. The major crops grown are maize, haricot bean and potato. Coffee also grows in some villages for generating cash income.

The data was collected in 2006 from 200 farm households. It covers production and marketing information for 2005 and 2006 production seasons. Samples were selected from

---

<sup>8</sup> Annual variability indicates the maximum of the annual mean price growth while seasonal variability indicates the maximum of the difference between a year maximum and minimum prices from Addis Ababa market.

ten villages, five from each woreda. They were interviewed using structured questionnaire that includes basic household and farm level characteristics, production and marketing of haricot bean, and household's involvement in contract and cooperative marketing. Since we have got two seasons information, the data was pooled over years that makes the sample size as large as 400.

## **Results and Discussion**

### *Market and contract choice*

Table 1 shows the definition and summary statistics of major variables used for analyzing market choice and commercialization. 85% of the total sample farmers grow haricot bean in 2005 and 2006. About 15% of them do not supply to the market. A farm household could supply as large as 2.8 ton per season that amounts about 7560 ETB ( 1 ETB=0.11USD). Out of the total farmers who supply haricot bean to market, 54% sold to spot market, 14% to relational contract and the rest 32% to cooperative market. Cooperative marketing is sharply increasing over time while relational contracting is declining.

The estimates of multinomial models are reported in Table 2. Multinomial logit assumes market choices are made simultaneously implying that farmers must choose one market out of spot, relational and cooperative markets at a time. Sequential logit assumes decisions are made consecutively in such a way that farmers first decide to participate in interlinked contract and then they choose among the markets. Estimates under the fourth column of Table 2 shows the first stage decision of choosing between spot market and interlinked contract market and estimates under the fifth column shows the second stage decision of choosing among interlinked contracts, where the reference choice is relational contract.

An overview of Table 2 shows that education, leadership role, distance to spot market, total cultivated land, livestock size and cash endowment are statistically significant factors

for market choice. Surprisingly, distance to market is related negatively to the choice of interlinked contracts. Farmers near to the market prefer to sale their grain through interlinked contracts. This must be, however, explained contextually. The distance to market may imply both transaction cost and information access. Those near to the market have lower transaction cost that may not encourage them to search for any institutional involvement to reduce cost. But they have also better access to information about new market innovations and hence they are likely to adopt such innovation prior to those who do not have access to the information. Some institutional innovations are exogenous in the sense that they are initiated by governmental and nongovernmental organization so that they are well organized around centers than distant places. As a result those who are near to the market are very likely to involve to interlinked contracts.

The major interest in this paper relies on the effects of livestock size, cash and adult labor endowment on contract participation and choice. This is because livestock size and cash availability serve as proxy for bargaining power effect and labor for discretionary pricing effect. The explanation for such representation at least for labor and cash must be clear from previous sections. With regard to livestock, it represents risk behavior through representing household wealth. In areas where land belongs to the public and other capitals are less developed, livestock unit remains the only indicator of household wealth status. This claim is in line with the local people's wealth ranking. Wealth in turn measures the household's risk behavior. Many empirical studies have reported an inverse relationship between risk aversion and household's wealth (Binswanger, 1981, Hagos and Holden, 2003, Wik and Holden, 1998).

All the models consistently showed that livestock size has very significant effect on the probability of choosing cooperative contract than other markets. As we see from the

sequential model, livestock ownership in fact is a strong determinant of engaging in any of the interlinked contracts. This implies that risk-averse farmers would like to minimize risk through marketing arrangements (contracts) prior to planting. A further examination of how risk matters in choosing between relational and cooperatives contracts clearly shows that those who are risk-averse tend to prefer cooperatives than relational contract because the bargaining power of a risk-averse seller will be reduced in relational contract market. We also observed that farmers with lower cash availability prefer cooperative than relational contract. All these indicate that the bargaining effect that undermines the net price received by risk averse and cash constrained farmers' forces farmers to refrain from involving on relational contract. This is consistent with our theoretical predication that unless buyer and seller are on the same foot, contract per se may not attract smallholders.

Though labor endowment is not statically significant on market choice, it seems those who have higher male<sup>9</sup> adult labor prefer relational than cooperative contract. The last column of table 2 shows that male labor endowment has negative effect on cooperative contract choice implying those who produce quality grain tend to sell through relational contract where they receive quality premium unlike the cooperative where there is no discretionary pricing.

#### *Determinants of commercialization*

In this section we discuss how bargaining power in relational contract and non-discretionary pricing in cooperative contract affect commercialization via cash availability and labor use respectively. The results of exogenous and endogenous switching models

---

<sup>9</sup> In the study area males are responsible for all farm operations including weeding, plowing, harvesting and threshing with small assistance from adult females. Thus, male adult labor is the right indicator of farm labor endowment.

estimations for marketed surplus, share of marketed surplus and area share<sup>10</sup> are presented in Tables 3, 4 and 5 respectively. As indicated in the tables, weak endogeneity of switching is detected in most of the equations. We controlled the endogeneity of switching using distance to market place and livestock size as instruments. We assume that these variables are important for market choice but not for commercialization. This is because once the seller makes a choice to engage in interlinked contract, the size supply to the market will no more be dependent on information access or risk-aversion.

The underlining premise is that interlinked transactions minimize factor and product markets imperfections and increase commercialization. But the empirical result revealed that cash constraint remains an important determinant of commercialization in spot market and relational contract. The very purpose of interlinked transaction, access credit for smallholders, is not realized. In a situation where credit is accessible, farmers' decision should have been separated from the farmers' cash endowment (Holden, 1998). Unfortunately this could not happen in relational contract. Unlike those farmers who participated in relational contract, farmers who participate in cooperative do not base their commercialization decision on their own cash endowment. The extent of commercialization in this contract is independent of households' liquidity constraint. This indicates that properly organized cooperative, indeed, helps to eliminate credit imperfections. The result generally reconfirms the theoretical prediction that bargaining power in relational contract undermines the impacts of interlinked transaction in eliminating capital constraint and integrating smallholders to markets.

---

<sup>10</sup> Since the dependent variable for share equations has a value in between zero and one, we used GLM estimation.



The negative effect of cash on area share both in relational and cooperative markets may be associated with factors other than bargaining power (table 5). As the farm household owns enough cash capital, non-farm activities (mainly trade) may generate better cash than haricot bean production and divert more land to food crops for own consumption. In the study areas it is not uncommon to observe farmers engaged on trading of coffee and vegetables.

Households' male labor endowment significantly explains farm households' variation in commercialization (marketed surplus and area share) in spot and relational market but not in cooperative market. As indicated by the high elasticity values the effect is higher in relational contract than sport market. A percentage increase in male adult labor increases commercialization as high as 70%. We also observe that male adult labor has consistently insignificant effect on all dependent variables in cooperative market (Tables 3, 4, 5). An important implication of this observation is that the production effect of labor endowment<sup>11</sup> is superseded by its price effect. As explained in equation (19), the price effect which is only observable in relational contract is found to be significant in commercializing smallholders. The price effect is an effect that encourages growers to enforce higher effort through providing discretionary price contingent upon observable quality and quantity indicators. In our field study, we observed relational contract buyers provide as high as 15% higher price than the market price contingent up on the size and quality of grain. As a result farmers who involve in relational contract are expected to use more labor than who involve in cooperative marketing. The mean comparison of mean labor use under each marketing arrangements shows that farmers under relational contract use 14% higher labor than those

---

<sup>11</sup> We assume that labor market is imperfect in the area and hence the use of labor in production is directly proportional to the size of family labor.

farmers who involve in cooperative (table 1). Thus, despite the problem of bargaining power that rationed out small growers from the market, relational contracting renders opportunity for relatively better of farmers to integrate in to markets and generate better cash income.

The explanation for the insignificance of labor endowment on commercialization in cooperative possibly associated with the double delegation problem that limits the enforcement of discriminatory price. Cooperative marketing is carried out by collectively delegated personnel who are responsible to grade and determine subjective prices. However, this assignment allows incentive for the person to be corrupted and colluded with sellers. It is not uncommon to see many failed cooperatives in Africa due to incentive problem (Akwabi-Ameyaw, 1997, deJanvry, et al., 1993). In order to prevent this incentive problem, cooperatives adopts non-discretionary price that all sellers have to be paid irrespective of the quality and quantity of grain supply. This has encouraged growers to supply lower quality grain. It also undermines the incentive of boosting cash crop (haricot bean) production and productivity.

Beans quality is an important issue when it comes to grain export market. Lower quality beans overrate the costs of marketers and reduces the net price received from the world market. The size, color and purity of seeds are important attributes to fetch better price and sustainable demand. However, Ethiopian pulse exporters repeatedly complain on lower quality of smallholder's supply that would undermine the long term competitiveness in international market. The institutional innovations such as interlinked contracts were initiated partly to improve the quality of grain through optimum use of weeding and harvesting time. But it seems that such promises are not met particularly for cooperative contracts.

### *Impacts on commercialization*

The summary statistics in table 1 shows that mean marketed surplus is higher in relational contract while area allocated to bean is higher in cooperative. The share of marketed surplus out of the total bean production is still larger in relational contract indicating the positive impact of interlinked contract on commercialization. Farmers who involve in cooperative tend to optimize the gain from bean production through expanding the area coverage rather than increasing yield or quality. As we can see from table 1, the average yield of growers under cooperative is lower than other growers. Since farmers receive uniform price, they have less incentive to allocate land intensifying resources to the production of bean. As a result, it seems they rather opt for area expansion. Unfortunately, the area expansion does not sufficiently translate in to increased market supply.

However, understanding the actual impacts of interlinked contracts on commercialization requires controlling the resource endowment of growers. Since resource endowed farmers likely to involve in relational contract, comparing commercialization without controlling resource endowment would be misleading. The literature on impact analysis is very wide and many procedures are evolving over time. Here we apply a parametric evaluation method in which the mean grain supply (marketed surplus and area share of the grain) values are predicted to all sample households using the parameter estimates of the switching regressions. Then, the predicted means are compared to see how an individual farmers' market supply is different in different markets. The results are reported in table 6.

The result showed that interlinked contract outperforms spot marketing. It causes statistically significant difference both in terms of marketed surplus and area allocation to haricot bean. Farmers who are in relational contract supply grain about 27% higher than their counterparts in spot markets. Comparison between cooperative and the spot market

showed that cooperative in fact helps smallholders to supply grains more than spot marketing where farmers are subjected to risky price. But in terms of share of marketed surplus to the total production, it did not help at all. The result is consistent with previous study (Bernard, et al., 2007) that uses non-parametric method to evaluate the impact of cooperative on commercialization. Comparison among interlinked contracts also shows that relational contracting impacts commercialization better than cooperative. Farmers in relational contracts supply 23% higher than those in cooperative. The explanation could be related to the presence and absence of discretionary incentive to enforce higher effort for the production of haricot bean. As we discussed before, on one hand, cooperative markets adopt uniform price while relational contract uses discretionary price. On the other hand, price is made through negotiation in cooperative unlike in relational contract where the buyer has a prime power. Given this context, the message is that discretionary effect overwhelmed the bargaining power effect. The finding supports the incomplete contract hypothesis that suggests if once some aspects of performance are unverifiable; it is optimal to leave other verifiable aspects of performance unspecified (Bernheim and Whinston, 1998). If the quality and quantity of grain are not enforceable, it seems rational to leave the price to be optional.

### **Concluding remarks**

The study assessed the role of interlinked contracts in accessing credit and hedging risk thereby enhancing commercialization. More specifically, it investigated the effects of resource endowment, risk aversion and other explanatory variables on smallholders' market choice and extent of commercialization. The following conclusions are emerged from the study. 1) Smallholders' market outlet choice appears to depend significantly on risk and

information access but not on marketing costs. Those who are risk averse and have better access to information are likely to choose cooperative contract. Unequal bargaining power in grain selling and buying makes relational contract less attractive to hedge risk. 2) The extent of commercialization measured by the marketed surplus and area allocated to marketable grain is indeed significantly influenced by bargaining power and non-discretionary pricing in grain markets. 3) Given the current circumstances, relational contract impacts commercialization better than cooperatives implying the discretionary effect is stronger than the bargaining power.

These findings imply the following policy recommendations. First, the ever existed attitude of considering relational contract as exploitation mechanism and discouraging its existence shall be reconsidered. Linking agro processors and small scale growers through informal contract do much better than organizing incentive incompatible formal cooperative. Second, cooperatives shall be reorganized to realize the goal of commercialization and economic transformation. It shall be redesigned to enforce higher efforts, discriminate free riders and sustain competence in seed quality and heterogeneity in world bean market.

## **References**

- Akwabi-Ameyaw, K. "producer cooperative resettlement projects in Zimbabwe: Lessons from a failed agricultural development strategy. ." *World Development* 25(1997): 437-456.
- Andersson, H. "Primary and secondary producers: Economic implications of contracts in the food marketing chains " *European Review of Agricultural Economics* 22(1995): 310-320.

- Bernard, T., E. Gabre-Madhin, and A. S. Taffesse (2007) *Smallholders' Commercialization through Cooperatives: A Diagnostic for Ethiopia*, International Food Policy Research Institute (IFPRI).
- Bernheim, D. B., and M. D. Whinston. "Incomplete Contracts and Strategic Ambiguity." *The American Economic Review* 88, no. 4(1998): 902-932.
- Binswanger, H. "Attitudes Towards Risk. Theoretical Implications of an Experiment in Rural India " *Economic Journal* 91(1981): 867-890.
- Bolton, P., and M. Dewatripont. *Contract Theory* London: Massachusetts Institute of Technology 2005.
- deJanvry, A., E. Sadoulet, and E. Thorbecke. "Introduction to a special section, state, market, and civil organizations: New theories, new practices, and their implications for rural development." *World Development* 21, no. 565-75(1993).
- FDRE (2005) *Plan for Accelerated and Sustained Development to End Poverty*. Addis Ababa., Federal Democratic Republic of Ethiopia.
- Greene, W. H. *Econometric Analysis* 5ed. New Jersey: Prentice Hall 2003.
- Hagos, F., and S. T. Holden. "Farm Input use Intensity of Smallholders in Northern Ethiopia: Do Risk preference matter? ." Department of Economics and Social Science
- Hausman, J. A., and D. L. McFadden. "A specification Test for the Multinomial Logist Model." *Econometrica* 52(1984): 1219-1240.
- Holloway, G., et al. "Agroindustrialization through institutional innovation: Transaction costs, cooperatives and milk-market development in the east-African highlands " *Agricultural Economics* 23, no. 3(2000): 279-288
- Hviid, M. "Relational Contracts, Repeated Interaction and Contract Modification." *European Journal of Law and Economics* 5(1998): 179-194.
- Key, N., and D. Runsten. "Contract Farming, Smallholders, and Rural Development in Latin America: The Organization of Agroprocessing Firms and the Scale of Outgrower Production." *World Development* 27, no. 2(1999): 381-401.
- Laffont, J.-J., and D. Martimort. *The Theory of Incentives: The principal-agent model* New Jersey Princeton University Press, 2002.
- Little, P. D., and M. J. Watts (1994) *Living Under Contract: Contract Farming and Agrarian Transformation in Sub-Saharan Africa*, Madison: University of Wisconsin Press.

- Maddala, G. S. *Limited-Dependent and Qualitative Variables in Econometrics* Cambridge University Press, 1983.
- Masakure, O., and S. Henson. "Why Do Small-Scale Producers Choose to produce under Contract? Lessons from Nontradational Vegetable Exports from Zimbabwe " *World Development* 33, no. 10(2005): 1721-1733.
- Pingali, P. L. "From Subsistence to Commercial Production Systems: The Transformation of Asian Agriculture." *American Journal of Agricultural Economics* 79, no. 2(1997): 628-634.
- Porter, G., and K. Philips-Howard. "Comparing Contracts: An Evaluation of Contract Farming Schemes in Africa." *World Development* 25, no. 2(1997): 227-238.
- Sadoulet, E., and A. d. Janvry. *Quantitative Developemnt Policy Analysis* The Johns Hopkins University Press 1995.
- Sartoriusa, K., and J. Kirsten. "The boundaries of the firm: why do sugar producers outsource sugarcane production? ." *Management Accounting Research* 16(2005): 81-99.
- Sexton, R. J. "Cooperatives and the Forces Shaping Agricultural Marketing." *American Journal of Agricultural Economics* 68, no. 5(1986): 1167-1172.
- Silva, C. A. B. d. (2005) *The growing role of contract farming in agri-food systems development: drivers, theory and practice*. Rome, FAO.
- Simmons, P., P. winters, and I. Patrick. "An analysis of contract farming in East Java, Bali, and Lombok, Indonesia." *Agricultural Economics* 33(2005): 513-525.
- Timmer, C. P. "Farmers and Markets: The Political Economy of New Paradigms." *American Journal of Agricultural Economics* 79, no. 2(1997): 621-627.
- WDR (2008) *World Development Report 2008: Agriculture for Development*, ed. W. Bank.
- Wik, M., and S. T. Holden. "Experimental Studies of Peasant's attitude Toward Risk in Northern Zambia ". Department of Economics and Social Sciences
- Wu, S. Y., and B. E. Roe (2007) *Discretionary Latitude and the Nature of Relational Contracting* Chicago, Illinois.

**Table.1. Summary statistics**

<b>Variable* Name</b>	<b>Variables' description</b>	<b>Spot market</b>	<b>Relational contract</b>	<b>Cooperative contract</b>	<b>Total</b>
N	Observations	168	42	100	310
WOREDA =1	1= Meki, 0= Borchha ,	46	51	53	49
YER=1	1= 2006, 0=2005	35	36	93	54
AGE	Age	40.16	40.69	41.21	40.57
EDU	Years of schooling	3.68	4.50	4.05	3.91
LDR	Community leadership role, 1= if the household head has any role	47	50	58	56
PKA	The number of donkey, mule, camel and horse the household owned and used for transportation of grains	1.00	1.40	1.08	1.08
DMK	The household's home distance from the central market where grain is sold and Woreda administration is located (km)	5.41	5.23	4.23	5.01
DRD	The household's home distance from the nearest driving road	1.35	1.77	1.97	1.60
FAL	Female adult labor; the number of household members whose age is above 15 and below 65	1.90	2.14	1.84	1.91
MAL	Male adult labor; The number of household members whose age is above 15 and below 65	2.02	2.31	2.09	2.08
AEC	Adult equivalent consumers converted based adult consumer food requirement	1.72	1.74	1.78	1.74
OXN	The number of oxen the household owned and used for cultivation	2.78	3.00	2.90	2.85
LU	Animals owned by the household, aggregated based on their values. It is an indicator of household's wealth.	11.22	11.48	11.18	11.24
TLS	Total owned land size	2.48	3.01	2.74	2.63
TCA	Total cultivated land in hectare includes both owned and rented-in lands	2.91	3.53	3.71	3.25
CSH	The amount of cash the household owned obtained from non-farm income and perennial cash crops and saving in 000'	3.14	3.95	3.06	3.23
	Bean area in hectare	0.64	0.77	0.89	0.74
	Bean area share	0.27	0.25	0.28	0.27
	Mean bean production(100kg)	5.22	8.54	7.31	6.34
	Marketed surplus in 100kg	4.66	7.88	5.72	5.42
	Share of marketed surplus	0.87	0.88	0.83	0.86
	Yield per hectare (100kg/ha)	9.15	11.62	8.07	9.14
	Labor per hectare	51.06	51.33	45.08	49.04

\* mean for continuous variables and percentage for categorical variables



**Table.2. Determinants of smallholders' Contractual choice (coefficients (standard errors))**

<i>Explanatory Variables</i>	<i>Multinomial Logit</i>			<i>Sequential Logit</i>	
	<i>RIC Vs Spot</i>	<i>CIC Vs spot</i>	<i>CIC Vs RIC</i>	<i>Contract Vs Spot</i>	<i>CIC Vs RIC</i>
woreda	0.620 (0.78)	0.957 (0.62)	0.337 (0.76)	0.829 (0.53)	-0.189 (0.79)
yeardummy	0.125 (0.38)	3.780*** (0.56)	3.655*** (0.59)	2.017*** (0.29)	4.258*** (0.72)
AGE	0.010 (0.02)	0.008 (0.02)	-0.002 (0.02)	0.008 (0.02)	-0.059* (0.03)
EDU	0.165** (0.08)	0.077 (0.08)	-0.088 (0.09)	0.116* (0.06)	-0.184 (0.13)
LDR	-0.653* (0.37)	-0.007 (0.37)	0.646 (0.43)	-0.297 (0.30)	0.846 (0.54)
PKA	0.338* (0.19)	0.007 (0.17)	-0.331 (0.22)	0.137 (0.14)	-0.269 (0.26)
DMK	-0.117 (0.07)	-0.254*** (0.06)	-0.137** (0.06)	-0.193*** (0.06)	-0.118* (0.07)
DRD	0.196 (0.13)	0.213 (0.13)	0.017 (0.05)	0.213 (0.13)	0.020 (0.04)
FAL	0.122 (0.14)	0.031 (0.16)	-0.091 (0.16)	0.065 (0.13)	0.026 (0.23)
MAL	0.187 (0.20)	0.135 (0.19)	-0.051 (0.24)	0.162 (0.15)	-0.113 (0.31)
AEC	-0.028 (0.12)	-0.088 (0.13)	-0.060 (0.15)	-0.056 (0.11)	-0.064 (0.19)
TCA	0.092 (0.12)	0.384*** (0.12)	0.291** (0.14)	0.249*** (0.09)	0.427*** (0.15)
OXN	0.003 (0.15)	0.144 (0.14)	0.142 (0.16)	0.079 (0.12)	0.264 (0.18)
LU	-0.074 (0.06)	-0.102*** (0.04)	-0.028 (0.06)	-0.087*** (0.03)	-0.094 (0.06)
CSH	0.023 (0.02)	-0.005 (0.01)	-0.028 (0.02)	0.006 (0.01)	-0.030* (0.02)
_cons	-2.567*** (0.96)	-3.719*** (1.06)	-1.152 (1.27)	-2.038*** (0.75)	1.079 (1.92)

RIC=Relational interlinked contract , CIC= cooperative interlinked contract

**Table.3. Estimation of marketed surplus (Coefficients' and standard errors)**

<i>Explanatory variables</i>	<i>Exogenous switching</i>			<i>Endogenous switching</i>		
	<i>Spot</i>	<i>RIC</i>	<i>CIC</i>	<i>Spot</i>	<i>RIC</i>	<i>CIC</i>
yeardummy	-0.093 (0.09)	0.125 (0.22)	-0.325** (0.16)	0.092 (0.27)	-0.042 (0.35)	-1.660** (0.71)
woreda	-0.405*** (0.12)	-0.052 (0.21)	-0.91*** (0.17)	-0.45*** (0.14)	-0.205 (0.28)	-0.73*** (0.20)
lnAGE	0.197 (0.20)	-0.781* (0.41)	-0.126 (0.36)	0.185 (0.20)	-0.865** (0.42)	-0.233 (0.41)
lnEDU	0.136** (0.06)	0.254** (0.10)	-0.028 (0.13)	0.170** (0.07)	0.300*** (0.11)	-0.098 (0.14)
lnOXN	-0.251** (0.10)	-0.104 (0.29)	0.079 (0.15)	-0.281** (0.11)	-0.247 (0.36)	0.148 (0.16)
lnPKA	0.277** (0.12)	-0.185 (0.22)	-0.117 (0.16)	0.282** (0.12)	-0.099 (0.29)	0.051 (0.17)
lnDRD	-0.010 (0.03)	-0.051 (0.06)	-0.013 (0.05)	0.002 (0.03)	-0.021 (0.07)	-0.080 (0.06)
lnMAL	0.212* (0.11)	0.778*** (0.20)	0.174 (0.14)	0.242** (0.12)	0.849*** (0.23)	0.116 (0.14)
lnFAL	-0.172* (0.10)	0.278 (0.19)	0.174 (0.17)	-0.193* (0.10)	0.350 (0.22)	0.339* (0.17)
lnAEC	-0.109 (0.17)	-1.21*** (0.37)	-0.528 (0.33)	-0.087 (0.17)	-1.25*** (0.39)	-0.627* (0.35)
lnCSH	0.154*** (0.05)	0.138* (0.07)	-0.159* (0.09)	0.139*** (0.05)	0.123* (0.07)	-0.061 (0.11)
lnTCA	0.691*** (0.11)	0.679** (0.28)	1.256*** (0.18)	0.770*** (0.17)	0.877** (0.32)	0.904*** (0.25)
imr				-0.957 (1.26)	2.668 (2.93)	-4.452* (2.25)
_cons	0.322 (0.69)	5.272*** (1.64)	2.104 (1.32)	0.629 (0.82)	3.703* (2.03)	6.242** (2.71)
r2	0.53	0.75	0.55	0.53	0.76	0.57
bic	311.5395	80.70454	217.3686	316.1194	83.3293	217.3466
N	164	40	92	164	40	92

**Table.4. Determinants of share of marketed surplus- GLM estimation (coefficients (standard errors))**

<i>Explanatory variables</i>	<i>Exogenous switching</i>			<i>Endogenous switching</i>		
	<i>Spot</i>	<i>RIC</i>	<i>CIC</i>	<i>Spot</i>	<i>RIC</i>	<i>CIC</i>
yeardummy	0.026 (0.03)	0.072 (0.06)	-0.038 (0.09)	0.103 (0.08)	-0.024 (0.07)	0.212 (0.16)
woreda	0.079** (0.04)	-0.003 (0.05)	-0.051 (0.06)	0.061 (0.04)	-0.092 (0.08)	-0.083 (0.06)
lnAGE	0.068 (0.07)	-0.299** (0.12)	0.034 (0.12)	0.063 (0.07)	-0.35*** (0.12)	0.054 (0.12)
lnEDU	0.010 (0.02)	0.079** (0.03)	-0.003 (0.04)	0.025 (0.02)	0.105*** (0.04)	0.010 (0.04)
lnOXN	-0.043 (0.03)	-0.017 (0.08)	-0.112** (0.05)	-0.055 (0.04)	-0.099 (0.09)	-0.124*** (0.05)
lnPKA	0.030 (0.03)	-0.103 (0.06)	0.029 (0.05)	0.032 (0.03)	-0.054 (0.06)	-0.003 (0.05)
lnDRD	0.019 (0.01)	-0.039* (0.02)	0.015 (0.01)	0.024* (0.01)	-0.022 (0.02)	0.027** (0.01)
lnMAL	0.004 (0.03)	0.238** (0.10)	-0.015 (0.04)	0.017 (0.03)	0.278*** (0.09)	-0.003 (0.04)
lnFAL	-0.053* (0.03)	-0.032 (0.06)	0.081 (0.06)	-0.061* (0.03)	0.009 (0.07)	0.050 (0.06)
lnAEC	0.031 (0.06)	-0.349* (0.19)	-0.203* (0.12)	0.040 (0.06)	-0.371* (0.19)	-0.185 (0.12)
lnCSH	0.030* (0.02)	0.020 (0.02)	-0.024 (0.02)	0.023 (0.02)	0.011 (0.02)	-0.042* (0.02)
lnTCA	-0.020 (0.03)	0.088 (0.08)	0.176*** (0.06)	0.013 (0.05)	0.202* (0.12)	0.241*** (0.07)
imr				-0.400 (0.41)	1.537* (0.91)	0.835* (0.44)
_cons	0.573** (0.29)	2.316*** (0.53)	1.008* (0.58)	0.701** (0.33)	1.412* (0.74)	0.232 (0.55)
bic	-49.3478	5.836833	5.133296	-45.0686	7.194793	8.07487
<b>N</b>	164	40	92	164	40	92

**Table.5. Determinants of area share to beans-GLM estimation (coefficients (standard errors))**

<i>Explanatory variables</i>	<i>Exogenous switching</i>			<i>Endogenous switching</i>		
	<i>Spot</i>	<i>Contract</i>	<i>Coop</i>	<i>Spot</i>	<i>Contract</i>	<i>Coop</i>
yeardummy	-0.009 (0.02)	0.064** (0.03)	0.026 (0.04)	-0.084 (0.06)	0.079** (0.04)	-0.186 (0.12)
woreda	-0.056** (0.03)	-0.012 (0.03)	-0.14*** (0.03)	-0.038 (0.03)	0.002 (0.03)	-0.11*** (0.03)
lnAGE	0.161* (0.07)	0.000 (0.06)	0.065 (0.05)	0.165** (0.07)	0.008 (0.06)	0.056 (0.05)
lnEDU	0.049*** (0.02)	0.055*** (0.02)	0.020 (0.02)	0.036 (0.02)	0.051*** (0.02)	0.008 (0.01)
lnOXN	-0.013 (0.02)	0.034 (0.03)	0.023 (0.02)	-0.000 (0.02)	0.046 (0.03)	0.037* (0.02)
lnPKA	0.039 (0.03)	-0.055** (0.02)	-0.023 (0.02)	0.037 (0.03)	-0.063** (0.03)	0.001 (0.02)
lnDRD	-0.001 (0.01)	-0.018** (0.01)	-0.003 (0.01)	-0.005 (0.01)	-0.021** (0.01)	-0.014 (0.01)
lnMAL	0.058** (0.03)	0.109*** (0.03)	0.037 (0.03)	0.047* (0.03)	0.102*** (0.03)	0.028 (0.03)
lnFAL	0.025 (0.02)	-0.044 (0.03)	0.002 (0.02)	0.034 (0.02)	-0.051 (0.03)	0.029 (0.03)
lnAEC	-0.09*** (0.03)	-0.138** (0.06)	-0.076 (0.05)	-0.10*** (0.03)	-0.134** (0.06)	-0.097* (0.05)
lnCSH	-0.008 (0.01)	-0.03*** (0.01)	-0.023** (0.01)	-0.001 (0.01)	-0.025** (0.01)	-0.007 (0.01)
lnTCA	-0.11*** (0.04)	-0.062* (0.03)	-0.024 (0.02)	-0.140** (0.05)	-0.080* (0.04)	-0.085** (0.03)
imr				0.388 (0.31)	-0.239 (0.36)	-0.709** (0.35)
_cons	-0.143 (0.23)	0.431* (0.25)	0.195 (0.19)	-0.264 (0.26)	0.569* (0.33)	0.835** (0.37)

**Table 6. Mean Comparison of commercialization under different markets (predicted means)**

<i>Commercialization</i>	<i>Mean</i>			<i>Mean differences</i>		
	<b>Spot (1)</b>	<b>RIC (2)</b>	<b>CIC (3)</b>	<b>(2)-(1)</b>	<b>(3)-(1)</b>	<b>(3)-(2)</b>
Marketed surplus						
Exogenous switching	3.74	5.47	4.01	1.73***	0.27**	-1.46***
Endogenous switching	3.71	5.47	3.94	1.77***	0.23*	-1.54***
Marketed surplus share						
Exogenous switching	0.87	0.9	0.83	0.03***	-0.04**	-0.07***
Endogenous	0.87	0.9	0.83	0.03***	-0.04**	-0.07***
Area share						
Exogenous switching	0.26	0.28	0.28	0.02***	0.02***	-0.002
Endogenous switching	0.26	0.28	0.27	0.02***	0.01***	-0.004

The values are predicted means for the whole sample



# Paper IV





# Clientelism among Smallholders and Grain Traders in Ethiopia: Opportunity or Threat?

Getaw Tadesse

Department of Economics and Resource Management

Norwegian University of Life Sciences

e\_mail: [getaw.gebreyohanes@umb.no](mailto:getaw.gebreyohanes@umb.no)

**Abstract:** *Agricultural commodity markets in Africa are characterized by informal transactions in which social networks and personal acquaintances are widely recognized means of exchange. Clientelism is one form of informal transaction in which a buyer and a seller interact repeatedly over an extended period of time. This paper explores the empirical rationales behind clientelism, as well as potential problems that arise as a result of its widespread use. The empirical tests are based on estimation of reduced form of regression equations derived from a time-varying repeated game. The structural games have been formulated to replicate the setting of Ethiopian grain markets. The theoretical analysis predicts that if participation in clientelism is driven by information access and screening cost, then repeated transaction will create trust among incumbents and restrict new market entrants. These predictions are tested using data from two markets in Ethiopia in 2009. Results support the view that clientelism has been driven by access to information and the costs of screening. Further, clientelism is seen to have positively impacted prices received by producers. This implies that establishing a degree of trust that results in receiving better prices, requires considerable investment that would make break up costly and market entry difficult. A policy implication is that steps to improve information access and reduce uncertainty will not only increase prices received by farmers but also enhance the long-term competitiveness of markets.*

*JEL: O13; Q13; L14*

*Key words: Information uncertainty, clientelism, repeated transaction, market entry, Ethiopia*

## Introduction

Agricultural commodity markets in Africa have been described as flea markets in which transactions are small and numerous, and these transactions are primarily conducted on a cash-and carry basis (Fafchamps and Minten, 2001). In these markets, one observes no order placement, no invoicing or payment by check, little reliance on credit, and no warranty. Legal systems that underpin the existence and enforcement of exchange in

developed economies are either missing or highly ineffective. As a result, these markets are characterized by high transaction costs, large price risks and frequent government interference (Barrett and Mutambatsere, 2005). In order to reduce or avoid these pitfalls, producers typically sell their products through a variety of informal channels, relying on personal acquaintances, social networks and clientelism. Clientelism is one form of exchange enforcement mechanism that prevails within the wider spectrum of exchange known as a bazaar market (Gabre-Madhin, 2009). Geertz (1978) has defined clientelism as “the tendency for repetitive purchasers (sellers) of particular goods and services to establish continuing relationships with particular purveyors (buyer) of them, rather than search widely through the market at each occasion of need.”<sup>1</sup> Clientelism helps to reduce costs related to information uncertainties and helps to secure social services such as administrative, legal and credit services during crop failures, and storage service for grains if the day’s price is very low.

Smallholder producers face information uncertainty between the times of land preparation and harvest and sale. Of particular importance is the information uncertainty in the market place where producers gamble not only with their ‘ignorance’ but also with the strategic reaction of the informed buyers. On one hand, producers hardly know the ongoing central market price for the quality and quantity of grain that they are supplying to the market. Most producers do have little information about the central market price of the day and the weight of their produce while they are packing for sale. Moreover, grain quality

---

<sup>1</sup> This is the Economics definition of clientelism. In Political Science clientelism refers to a form of social organization characterized by "patron-client" relationships, where relatively powerful and rich "patrons" promise to provide relatively powerless and poor "clients" with jobs, protection, infrastructure, and other benefits in exchange for votes and other forms of loyalty including labor (Robinson, and Verdier, 2003). While this definition considers clientelism as an exploitation mechanism, in economics in general, in this paper in particular, clientelism is considered as economic mutualism whereby both parties can be benefited.

standard is very subjective. No one in the market perfectly grades grains except experienced buyers. In large urban markets, let alone small rural markets, quality standards are rare. On the other hand, local traders who buy grain from producers know the market better than producers<sup>2</sup>. Knowing that producers often lack full information regarding the day's price and the weight and grades of their produce, buyers usually offer lower price than the on-going market price. If producers think that they have been cheated, there is no formal way of reclaiming or reinforcing agreements. Thus, smallholders bear huge transaction cost either through receiving a value lower than the market value (moral hazard problem) or through incurring substantial cost for searching the right price.

Though clientelism possibly reduces information uncertainty and improves sellers' access to social services, it may, unfortunately, jeopardize the long-term competitiveness of the market by restricting the entrance of new traders into the market. If a seller or a buyer extends loyalty to a specific buyer or supplier, it becomes difficult for new buyers or suppliers to enter. As a result, an incumbent buyer behaves like a monopolist, generating potential deadweight losses. Intuitively, one might expect loyalty to emerge when the cost of establishing new relationships is large. This motivates us to ask whether observed levels of information uncertainty are sufficient to motivate producers to engage in clientelism and whether the cost of establishing new relationships is large enough to encourage agents to remain loyal.

Our basic argument is that a lack of a well-established information system motivates producers to engage in clientelism if repeated client-based transactions provide the grounds

---

<sup>2</sup> Producers, in some respect, have better information than traders. Particularly, producers know the cost of production and the harvest condition in rural areas better than traders. This may help to forecast the local market supply and price. However, this information has less relevance to predict the central market price which is determined by the interplay of the nation's aggregate supply and aggregate demand. Small producers have little information on these variables.

to establish trust and trustworthiness among exchanging parties. Repeated transactions deter opportunistic breaches in contract because the costs of observing actions and searching for information are high (Banks, et al., 2002, Fafchamps, 2004, Hviid, 1998, Klein and Leffler, 1981). Experience in developed markets showed that repeated transaction establishes trust and reduces behavioral risks (Kanagaretnam, et al., 2009). Conceptual and empirical analysis within the African context indicated that personalized relationships that involve frequent transaction have improved contract enforcement (Fafchamps, 1996, Lyon, 2000). Establishing network social capital through repeated transaction among grain traders in Ethiopian central market has also improved the welfare of traders (Gabre-Madhin, 2001). However, evidences are lacking on village level transactions, where producers' prices are determined.

This paper measures the effects of information and screening costs on the emergence of clientelism in rural Ethiopian grain markets. It also evaluates the effect of participation in clientelism on farm gate prices. We observe exchanges between producers and traders to test whether 1) clientelism creates trust among producers and traders 2) the cost of establishing a relationship is large enough to restrict market entry. To do so, we formulate time-invariant structural games that replicate the settings of Ethiopian grain markets and derive reduced form of equations. The reduced equations are estimated using data from two rural markets. Our findings provide insights into how informal institutions evolve to fill the void of missing formal institution and this institution by itself is imperfect.

### **Rural Grain markets in Ethiopia**

Rural grain markets in Ethiopia could be described as flea markets in which marketing is carried out on few days of the week, transactions are very small, market participants are

many and very small and sales are purely carried out on cash-and-carry basis. These markets hold two parallel bazaars<sup>3</sup> in the same day and at the same place. The first bazaar is auction-type market which is very informal and has no any connection to the central market. Buyers in this market are consumers and retailers who need premium quality. The size of this bazaar is very limited on those commodities that have significant quality differences. Price is determined through decentralized negotiation between a buyer and a seller at a time. The sellers are the ones who offer the prices that the buyers either accept or reject or offer alternative prices. In this case searching is carried out by the buyer. There is no weighing machine and hence the weight of grain is estimated through experience. Entry requires extensive experience on quality grading and quantity estimation or the use of brokers who have experience of doing so.

The second bazaar is the derived market that obtains price from the central markets. In this bazaar, grain buying price is supposed to be determined by deducting miscellaneous costs and a net traders' profit margin from the prevailing wholesale price in Addis Ababa (Dessalegn, et al., 1998). However, because of the information gap between sellers and buyers regarding the price in Addis Ababa, the actual price received by the producers is determined through decentralized negotiation between traders and producers. In this negotiation the trader offers the price and the seller decides either to accept or reject. Traders use their own weighing machine which could be in most cases dysfunctional. Since traders take a seat in the same place along a line, farmers can accept the first offer or reject and go for the other negotiation. The major participants in this bazaar are producers and wholesalers.

---

<sup>3</sup> A bazaar is a merchandizing marketplace where goods and services are traded openly

Marketing cost in the derived market depends on the flow of information regarding the on-going central market price, the quality grade of the grain and the weight of packed grain. Producers have limited access to this information – far more limited than traders. More than one third of producers do not know either the current market price or the quality or quantity of the produce they are bagging for sale. In the absence of product information, knowledge about the type of buyer has long been acknowledged as the best strategy of business interaction. Unfortunately, such knowledge is also very rare in rural areas. The presence of information gaps allows buyers to engage in opportunistic behaviors, for examples paying a price lower than the competitively-determined price. It also forces sellers to engage in relational transactions. For example, our survey in 2009 indicates that more than 65% of smallholder producers in a rural market in Ethiopia sell their grains through personal relationships. Even grain traders dealing in relatively small volumes sell to retailers and wholesalers through networks with brokers. These brokers handle almost 52 % of the nation's total marketed surplus (Gabre-Madhin, 2001). In the following section, we formulate a model that helps to conceptualize the theoretical links between information uncertainty and clientelism.

### **The Model**

Individuals often make calculated decisions about joining clubs, performing favors and making and maintaining relationships with an eye toward the future benefits of so doing. As a result, matching in grain markets is not random. Smallholder producers and local grain buyers face a similar social environment within which they develop certain aspects of trust that can be used for developing and furthering trade relationships. Therefore, sellers might be expected to sell to those they know best, with the assumption that the buyer has a social

and business incentive not to cheat even if the seller does not know the market price or quantity and quality standards.

The role of repeated transaction in creating trust and subsequently reducing transaction cost and improving contract enforcement has been studied (Fafchamps, 2004). The model presented here differs from previous contributions in two important ways. First the model is applied to a specific market where on-the-spot information searching is costly. Second, it considers a time-varying cost of establishing clientelism -- what may be called an investment or screening cost. The purpose of developing this theoretical model is to inform the components of a reduced-form equation to empirically test important implications of the model.

A repeated game involving trust is used to show how clientelism (repeated interaction) impacts the strategic behavior of sellers and buyers in an imperfect grain market. In a market where grain sellers accurately know the spot price for the quality and quantity of grain they have on offer, transactions can take place with any trader without meaningful cheating or loss. Under such circumstances neither party generates any rent or loss. They obtain normal levels of surplus  $b_k$  (for the buyer) and  $s_h$  (for the seller). However, the situation changes in the presence of information asymmetries. Let us assume that the seller (S) imperfectly knows the market price, product standard and weight before entering into the transaction. We denote this stock of knowledge as  $\omega_0 \in [0,1]$ . If the seller has full information,  $\omega_0 = 1$ . If the seller has no information  $\omega_0 = 0$ . We posit that knowledge is a stock that appreciates as a result of negotiating (haggling) with many buyers. Thus, the new

stock of knowledge  $\omega_n$  becomes  $\omega_n = \omega_0(1 + \sigma)^n$  where  $n$  is the numbers of buyers, and  $\sigma$  represents the rate at which negotiating generates knowledge.<sup>4</sup>

Using the structure of the trust game outlined by Kreps (1990), the game between the seller (S) and the buyer (B) is expressed as follows. The game begins with a decision for B, who can offer any price, including a price that is lower, higher or equal to the price prevailing in the central market. Hereafter, this prevailing market price is referred to as the competitive price. In response, S can choose either to accept (trust) or reject (not trust) the buyer's offer. If S chooses to reject then the game ends and the seller moves in search of another buyer, carrying with him the knowledge gleaned from the failed transaction. As a result of the failed transaction B gains  $b_0 = 0$  and S gains

$$s_0 = s_h - (1 - \omega_0(1 + \sigma)^n)V^m - nc \quad (1)$$

where  $V^m$  is the value of the seller's grain valued by the competitive price and  $c$  denotes information searching cost per negotiation. If, at the outset, B instead chooses to offer the competitive price and S chooses to sell, then both players' obtain competitive profits  $b_h$  and  $s_h$ . This is equivalent to a perfect market outcome. However, if B cheats by offering less than the competitive price and S chooses to accept, then S obtains  $s_b = s_h - (V^m - V_b^b)$  (i.e. S gives away some profits) and B gains  $b_b = b_h + (V^m - V_b^b)$ , where  $V_b^b$  is value of the seller's grain valued by the subjective price of the buyer.

---

<sup>4</sup>  $n \in \left[ 0, \frac{\ln(1/\omega_0)}{\ln(1 + \sigma)} \right]$



The solution depends on the number of interactions and the costs of transaction in each strategy. If B gets to move (i.e., if the seller chooses to sell) then B can receive either a payoff of  $b_h$  by honoring  $S'$  or a payoff of  $b_b$  by cheating  $S$ . Since  $b_b$  exceeds  $b_h$ , in a one-shot interaction in which the future relationship is not relevant, B will always prefer to cheat ( $V^b < V^m$ ) if given the chance. Knowing this,  $S$ 's initial choice is either to search for information from other buyers (incurring extra cost) or proceed with the transaction forgoing some profits. The decision whether to trust and sell to B or to search further depends on the difference between the payoff from selling when B cheats and the payoff from refusing the offer. Information searching is the seller's equilibrium if the seller's total cost under searching is lower than under cheating. That is

$$1 - \omega_0(1 + \sigma)^n V^m + nc \leq (V^m - V^b) \quad (2)$$

Those who have higher levels of initial knowledge and lower search costs will have a higher probability of opting for information searching. In a one-shot interaction, cheating is sub-game perfect for the buyer. However, the possibility of searching alters the buyer's subjective valuation. Rearranging the seller's equilibrium condition (1) gives us the optimal subjective price of the buyer as

$$V_b^{b*} = \omega_0(1 + \sigma)^n V^m - nc \quad (3)$$

Buyers generate a rent from information if the knowledge of the buyer is low, or the cost of searching for information is very high.

Instead of a one-shot interaction suppose that the seller and the buyer will transact repeatedly. In this case a previous outcome is observed by both players before the next exchange. The analysis of this repeated interaction differs dramatically from the one-shot

interaction in that B's action today may affect S's expectation of B's actions tomorrow. S's expectation, then, affects S's action and B's payoff tomorrow. Therefore, the trigger strategy of S would be to keep on selling to the trader if he reveals the true value in the first period but to move to other traders forever if he cheats. Given this strategy the trader will be left either to cheat and get a onetime information rent or reveal the true value and generate the competitive profit for long period of time. Let the duration of interaction is unlimited and B's and S's discount rates are  $r$  and  $\delta$  respectively, then the B's total payoff for infinite period interaction will be  $B_r = \sum_{t=0}^{\infty} \frac{b_c}{(1+r)^t}$ . B reveals the true value, that is

$V^b = V^m$ , if

$$\sum_{t=0}^{\infty} \frac{b_c}{(1+r)^t} \geq b_c + (V^m - V^b) \quad (4)$$

In areas where the credit market is imperfect, discount rates are individual specific. Thus, traders with high discount rates remain rent seeking because gains from establishing long-term partnerships are low.

Given that trustworthiness is valuable to B, S continues to transact if the gain from having the long-term relationship is greater than the gain from a one-shot interaction after searching for more information. That is

$$\sum_{t=0}^{\infty} \frac{s_h}{(1+\delta)^t} \geq \sum_{t=0}^{\infty} \frac{s_0}{(1+\delta)^t} \Leftrightarrow s_h \geq s_0 = [(1 - \omega_0(1 + \sigma)^n)V^m + nc] \geq 0 \quad (5)$$

where  $(1 - \omega_0(1 + \sigma)^n)V^m + nc$  represents the total transaction cost made up of losses due to cheating and searching. Equation (5) implies that so long as the transaction cost is high, sellers prefer to repeatedly transact with the same buyer provided that the buyer chooses

to reveal the true market value as a result of long-term trading. A successful partnership emerges if both parties are better off from the relationship.

So far we have assumed that clientelism is established without investment cost, which implies that the current action has no effect on future gain or loss. But this assumption is not realistic, particularly if the relationship depends on reciprocity. Farmers must incur substantial screening cost through continuous interaction with the potential partner even if the potential partner is not complying. The screening cost represents the amount of income lost during the screening phase or the cost incurred to examine the reputability of the potential client. This cost however will be declining as the relationship between the two parties strengthens. Whenever the screening cost is substantial but declining over time, the seller's payoff will never be constant. The net payoff will be increasing as the duration of relationship goes by. This makes the decision to participate in repeated transaction conditional on time-varying variables.

Let the screening cost be the deviation of the actual market value and the buyer's subjective valuation that decreases over time. We further assume that this cost depends on the information about the reputation<sup>5</sup> of the potential partner. If the seller's access to information about the reputation of the buyer is indexed by  $\beta \in [0,1]$ , where  $\beta = 0$  if the seller has no any information and  $\beta = 1$  if the seller has full information, then the screening cost will be

$$Sc_t = (1 - \beta)(V^m - V_t^b) \quad (6)$$

---

<sup>5</sup> Reputation refers to the probability that the trader is trustworthy. Traders tend to be trustworthy if they are better off from repeated interaction. Some buyers may be better off from cheating always even if they know that the sellers will not come back if cheated.

In the presence of screening cost, the seller continues to trade with the same buyer if the discounted net gain is higher than the gain from every time searching. That is

$$\sum_{t=0}^T \frac{S_t - (1-\beta)(V^m - V_t^b)}{(1+\delta)^t} \geq \sum_{t=0}^{\infty} \frac{S_0}{(1+\delta)^t} \quad (7)$$

Unlike in (5), the discount factors in this case cannot be netted out due to the time variability  $V_t^b$  in equation(7). An important implication of a positive investment cost is that a new trader will have a very small chance of trading with already matched farmers. This may threaten the competitiveness of the market.

The above structural equations can be summarized by the following reduced form of implicit function

$$P(CL=1) = f(\omega_0, \sigma, c, \beta, \delta) \quad (8)$$

where  $P$  is the probability of an outcome.  $CL$  is a binary variable that takes 1 if the producer sell based on clientelism, zero otherwise. Using these functions, the following testable predictions can be made

1. If  $\frac{\partial f}{\partial \omega_0} < 0$  and  $\frac{\partial f}{\partial c} > 0$ , then market information is an important problem to producers.

This means that clientelism helps to reduce transaction cost associated to lack of well-established market information and services. Therefore, clientelism establishes trust among trading parties and reduces the opportunistic behavior of buyers.

2. If  $\frac{\partial f}{\partial \beta} > 0$  and  $\frac{\partial f}{\partial \delta} < 0$ , then establishing clientelism will be costly. This is because the

discount rate and the seller's information about the reputation of the buyers become

important determinant if and only if the screening cost is substantial. Therefore, clientelism restricts market entry.

## **Data and Method**

### *The Data*

The data for the empirical analysis is obtained from a household survey conducted in 2009 in Southern Ethiopia. The study areas were Arsi Negele and Gununu woredas. Arsi Negele is located within the Oromia region while Gununu is located within Wolayta zone of the Southern Nations, Nationalities and Peoples region. Arsi-negele represents grain surplus producing areas while Gununu represents food insecure and deficit areas of the country. Arsi Negele has very good access for roads and hence markets are well developed than Gununu. About 150 farm households were sampled for interviews. Data were collected regarding household access to information, recent grain marketing practices and household characteristics. Households were randomly chosen and asked when they had last sold grain. Specific data were then collected regarding this last transaction. This approach was used to get accurate information regarding to whom they sold, how they sold, the quantity they bagged, and the price they received.

### *Method*

We postulate that sellers repeatedly transact with the same buyer to establish clientelism as a way of minimizing the costs of searching for information. Therefore, participation in clientelism is a function of searching costs and investment costs. Search costs push and investment costs pull sellers to establish clientelism. A search cost depends on knowledge about the market and product, the opportunity cost of labor, and the quantity of grain under transaction. However, as outlined in the previous section,

establishing clientelism requires an investment cost. The importance of this investment cost depends on the discount rate (inverse of wealth) and the seller's information about the reputation of the buyers. The following alternative models are used to examine the correlates with the decision to transact repeatedly with the same buyer:

$$\text{A. } CL_i = \alpha_2 + \gamma_2 APPI_i + \theta_2 Sc_i + \varepsilon_{2i}$$

$$\text{B. } CL_i = \alpha_3 + \gamma_3 APPI_i + \theta_3 Sc_i + \pi_3 W_i + \varepsilon_{3i}$$

$$\text{C. } CL_i = \alpha_4 + \gamma_4 APPI_i + \theta_4 Sc_i + \pi_4 W_i + \beta_4 Kb_i + \varepsilon_{4i}$$

where  $APP_i$  is a vector of household- and community-specific characteristics that represent the household's access to price and product information ( $\omega$ ). Some of these variables include distance from markets, experience (age), access to telephones, the presence of close family member in the market, ownership of radio and other village and personal characteristics.  $Sc_i$  is a vector that includes variables of representing per unit searching cost ( $c$ ). These variables include the size of grain the farmer sells in a marketing day, the household's labor endowment and the opportunity cost of labor as measured by participation on off-farm activity.  $Kb_i$  is the knowledge of the farmer about the reputation of potential buyers before engaging on partnership. It approximates the screening cost of participating in a network. Proxy variables for measuring seller's knowledge about the reputation of the buyer are distance of the seller's home to the market, the presence of close family member in the market, age (marketing experience), land owned per unit of consumer and prior kinship between buyer and seller. Land per consumer unit explains total grain production as well as total marketed surplus. The one with higher size of marketed surplus is supposed to visit the market more frequently than others. This enhances the chance of the seller's access to buyers' action.  $W_i$  is the wealth of a producer to represent

for discount rate of individual households. Many studies confirmed that personal discount rates are inversely related to wealth of the person. We measured wealth by the size of livestock or the type of house (whether iron roofed or grass roofed) and the number of houses owned.

Since the dependent variable  $CL_i$  is a binary choice variable, all models were estimated as Probit regressions. In order to test the robustness of the Probit estimation and further investigate the extent of clientelism, we estimated a Tobit model that uses the duration of partnership as the dependent variable. The duration of partnership refers to the number of years in which a trader and producer remained clients. The value is zero for those who do not participate in clientelism.

Farmers receive different prices for the same commodity in the same market. Possible explanations are information access, discretionary incentive and quality standard of the commodity. Assuming that clientelism helps to reduce information access problem, the impact of clientelism on the producer price can be estimated using the regression:

$$D. \quad p_i = \beta_0 + \beta_1 X_i + \beta_2 CL_i + e_i$$

where  $p_i$  is per kilogram price received by the  $i^{th}$  producer in the most recent selling of a given crop. Since price varies over time, the period was limited within three weeks.  $CL_i$  is a binary variable that takes the value 1 if the producer participates in clientelism, and zero otherwise.  $X_i$  represents a vector of covariates that includes location, discretionary incentive and quality standard of the commodity. Discretionary incentive is represented by quantity of grain supplied because buyers provide bonus price if the seller supply more grain (see chapter 4). Since we lack reliable information on quality standard, this may cause a

self-selection problem in equation (D). To control for any possible self-selection, the following alternative model is estimated

$$\text{E. } p_i = \beta_0 + \beta_1 X_i + \beta_2 \widehat{CL}_i + \varepsilon_i$$

where  $\widehat{CL}$  is the linear prediction of model (C).

## **Results and discussion**

### *Preliminary observations*

Less than half of the sample, who sold grains (wheat & maize) and vegetables (onion, potato and green paper) to local markets reported that they are uncertain about price and product information prior to selling (Table 1). When producers lack access to market information, they opt for on-spot information searching. More than 70% of grain producers negotiate with two or more traders in a single marketing day before selling their product. It is not uncommon to negotiate with seven traders for selling a bag of grain. Absence of grain quality grades and small size of supply make negotiation a viable option to search for the right prices. Searching, however, entails huge cost of loading and unloading while physically moving the product, time spent of searching and all other hassles in the process. As an alternative to the costly case-by-case negotiation, producers tend to transact through social networks, acquaintances, and personal relationships. Farmers sell their products to a buyer with whom either they have long term business partnership or they have blood and social kinship or they have prior acquaintances. More than 60% of producers sell based on acquaintances. Three out of ten producers sell to the same buyers every time. Two out of ten producers sell to their near kin. Whenever the formal institutions fail to support the marketing system, it seems very natural for people to adopt informal ways of dealing with transactional problems.



Table 2 presents descriptive statistics on major household specific variables. The value of each variable is categorized based on participation in clientelism. Of all the sample households about 72% have supplied grain in recent times. Obviously, the number of producers who supply grain to the market is larger in Negele than in Gununu. The number of sellers who sold for the same buyer is also higher in Negele than Gununu. Sample households supply an average size of 1800 kilograms in a single sale. This size seems very large. But the survey time was a period of settling all debts including fertilizer credits and taxes so that producers have to supply large quantity of grain per day unlike other times. Half of the sample households own radio and about 45% have access to private or public phone. The samples were as near as one kilometer and as far as 18 kilometers from the market place.

#### *Probit and Tobit estimates*

Table 3 presents the results of Probit and Tobit estimations for the different models specified above. The models' prediction power ranges from 70 to 76 percent. Most estimated parameter values are robust to alternative specifications. In terms of prediction power based on model selection criteria (*aic*, *bic*) and  $X^2$  value, out of Probit specifications, model C performs better than others. Tobit estimation measures the extent of clientelism measured by years of duration. The Tobit estimates are comparable to Probit estimates except on few variables (market distance and having close relative in urban centers). Seven out of the twelve variables have statistically significant coefficients.

The result shows that information uncertainty adequately explains the establishment of clientelism. The presence of telephone –private or public, household head age, education and quantity sold have consistent and significant effect on participation in clientelism.

These variables represent access to price and product information and hence farmers who have access to private or public phone have lower probability of establishing long term partnership. Those with telephone access would easily get price information of the day prior to selling so that they do not need to sell their grain to a known buyer. Both private and public phone access are being expanding in rural Ethiopia in recent periods. This expansion has shown undeniable effect on grain marketing practices.

Education and age of the household head inversely and significantly associated to participation in clientelism. Better education mainly augments the seller a better position of selling to anyone because he/she can read the scaling machine and able to calculate the total price. One of the sources of cheating in grain market is traders' miscalculation of the total price even if the producers know the exact quantity and per unit price of the grain at hand. Age of the household indicates marketing experience that provides knowledge about the size of packing bags and the standards of the grain quality. As a result those who have experience (aged people) and education can easily sell to anyone without being cheated.

The quantity of grain (denoted as "bulk size") that a producer carried for sale has positive and significant effect on the probability of establishing clientelism. Producers who supply higher amount of grain would likely have higher cost of searching because of the need to move all grains while searching. Moreover, for a trader, the cost of losing a big seller is higher than the cost of losing small seller so that the trader provides different incentives to hold on such sellers as clientele. Besides offering the actual price, discretionary incentive is most common way of attracting producers (see the next chapter).

The types of house, market distance and having close relatives in urban areas have significant effect on participation in clientelism. The type of house being corrugated roofed or not to a greater extent determines the household wealth status in a transition economy.

Other wealth indicators such as total livestock unit and the number of houses are not significant at all.

Market distance may represent information access either about price and product or about buyers' reputation. The distinction depends on its sign. If market distance represents price and product information, households far from the market are more likely participate in partnership than near households. The result, however, indicates inverse relation that would support the idea of representing market distance as indicator of information about buyer's reputation. Information about buyer's reputation reduces the level of screening cost. Thus, a negative significance of market distance implies the decisiveness of screening cost on seller's decision to engage on long term partnership.

The presence of close relative in a town was included to test if repeated transaction is dictated by the availability of information with regard to the reputation of the buyer or the need for getting non-information services such as storing grains while the price is low, first keen, etc. If the sign of urban relative was negative, it indeed was meant for non-information benefits. However, the result revealed that the presence of close relative in urban areas is positively related to the probability of selling to the same buyer. This implies that the information access about the potential partner is a significant factor to establish clientelism.

#### *Implication on trust and market entry*

A strong association between information access and clientelism implies that despite widespread interventions by the Ethiopian government, farmers still face significant problem of market information. This problem leads to repeatedly transact with the same buyer with the hope that trust will emerge out of the relationship. Asymmetric information and monitoring problems expose sellers to behavioral risks. Clientelism is a response to

minimize these risks. In the absence of verifiable agreement and enforcing formal institutions, clientelism helps to establish mutual trust among trading parties. However, clientelism may not necessarily make a buyer honest because it could be optimal for the buyer to generate a onetime rent than foreseeing the future benefits from mutual trust. Producers were asked whether they have been cheated by their buyer or not. Of all the sellers about 39% perceive that they have received a value lower than the actual price. This number becomes quite contrasting when sellers are grouped in to participants and non-participants in clientelism. While only 23% of the sellers are cheated when they sell to their client, well above 48% are cheated when they sell to anyone.

The effect of screening cost on participation is strong. The negative and significant effects of market distance and having close relative in urban areas on participation show the importance of screening cost in establishing clientelism. As implied by the joint test, wealth has also a positive and statistically significant effect on selling grain through clientelism. Wealthy households are expected to have lower discount rate than poor households that makes the cost of establishing clientelism lower for rich than the poor. Besides the indication that poor people are selected out from such informal institution, the result reconfirms the importance of investment costs in establishing clientelism.

If screening cost is decisive to join clientelism, the long-term competitiveness of commodity markets will be jeopardized. As argued earlier, if establishment cost is substantially high break-up among matched trading partners becomes so difficult so that new traders will find very small space to engage in. It is very rational for a producer not to break the relationship on which he has invested much to establish. This private rationality will however generate losses in social welfare by creating village level monopsony in the long run.

### *The effect of clientelism on producer price*

Farmers receive different prices for the same commodity in the same market within the same week. We estimated price functions (D and E, above) to examine whether this price difference is explained by participation in clientelism. In these functions we include only few variables because of lack of adequate information on other potential determinants. However, the functions explain close to half of the total variations (Table 4.). The result shows that clientelism has positively and significantly affected the amount of price a farmer can receive in a given transaction. Establishing clientelism increases producer price by more than 600 ETB per ton. This value becomes bigger than 1000ETB per ton when self selection is controlled. The marginal effect of clientelism on price appears to be very high. This could be because of not controlling other important determinants including specific date of sale and quality of grains. Those who supply quality grain may form clientelism and the buyer will like to maintain them by paying higher price premium. Even if quality difference of maize and wheat grains is not very big as of *teff*, it will have impact to a lesser extent. We collected the price data for sales made within three weeks. Though the daily price variability is not very high, certainly price will vary within these three weeks. Despite these limitations, the result robustly supports the view that clientelism helps to reduce marketing malpractices that would have resulted in receiving reduced price. In a market where public information easily flows to every potential participant, price should be the same to all.

### **Concluding remarks and policy implication**

Transaction in a rural commodity markets is carried out through a variety of informal social relationships such as personal acquaintances, social networks, clientelism and kinships. This paper assessed the rationale behind clientelism and its possible consequences

on the performance of the market. The performance of the market is measured in terms of establishing trust, reducing marketing malpractices and limiting market entry. The result indicates that clientelism is highly motivated by such factors as price and product information uncertainties and excessive information searching costs. The result confirmed the hypotheses that clientelism establishes trust that is not enforced by legal institutions. We also observed that the pull factors such as discount rate and screening cost weakly determine the probability of participation in clientelism. Therefore, clientelism will possibly restrict market entry and jeopardize the competitiveness of the market in the long run.

Informal institutions (example, clientelism) evolved when formal institutions are absent or weak and they help grain producers to reduce transaction cost and information access and receive better price. Unfortunately, they also jeopardize the long term competitiveness of the market. These results imply that informal institutions are not perfect substitute of formal institutions. Therefore, policy makers have to seek effective and efficient market institutions that would provide timely market information and enhance competitiveness as the same time. Along with the new commodity exchange market, a mechanism of price display and product standardization (both quality and quantity) in rural areas is needed to facilitate the process of smallholders' integration to markets as well as to protect the market from opportunistic behaviors. Establishing a warehouse receipt system in which producers could deliver their produce and obtain a receipt that certifies the quality and quantity of their produce could be one possibility. Though it seems costly in the short-term, the welfare gain will outweigh the cost in the long term. This system has worked in some African countries (Coulter and Onumah, 2002) . The new commodity exchange market initiative in Ethiopia shall consider expanding such system. Woreda level market regulatory bodies have to be empowered to monitor the correctness of private traders' weighing

machine. In the mean time, expanding telephone services would help smallholders' access up-to-date information. Currently, most rural villages have no connection at all.

## References

- Banks, D. T., J. W. Hutchinson, and R. J. Meyer. "Reputation in Marketing Channels: Repeated-Transactions Bargaining with Two-Sided Uncertainty." *Marketing Science* 21, no. 3(2002): 251-272.
- Barrett, C. B., and E. Mutambatsere (2005) *Agricultural markets in developing countries*, ed. L. E. Blume, and S. N. Durlauf, second Edition. London, Palgrave Macmillan.
- Coulter, J., and G. Onumah. "The role of warehouse receipt systems in enhanced commodity marketing and rural livelihoods in Africa " *Food policy* 27, no. 4(2002): 319-337.
- Dessaegn, G., T. S. Jayne, and J. D. Shaffer (1998) *Market Structure, Conduct, and Performance: Constraints on Performance of Ethiopian Grain Markets*. Addis Ababa, Ministry of Economic Development and Cooperation.
- Fafchamps, M. "The Enforcement of Commercial Contracts in Ghana." *World Development* 24, No. 3, pp. 427-448, no. 3(1996): 427-488.
- Fafchamps, M. *Market institutions in Sub-Saharan Africa: Theory and Evidence* Comparative Institutional Analysis sereis Edited by M. Aoki, A. Greif, and P. Milgrom. London The MIT Press, 2004.
- Fafchamps, M. *Market institutions in Sub-Saharan Africa: Theory and Evidence* London The MIT Press, 2004.
- Fafchamps, M., and B. Minten. "Property Rights in a Flea Market Economy." *Economic Development and Cultural Change* 49, no. 2(2001): 229-267.
- Gabre-Madhin, E. (2009) *Exchange, Contracts, and Property-Rights enforcement* ed. J. F. Kristen, et al. Washington, International Food Policy Research Institute
- Gabre-Madhin, E. Z. (2001) *Market Institutions, Transaction Costs, and Social Capital in the Ethiopian Grain Market*. WASHINGTON, D.C., IFPRI
- Geertz, C. "The bazaar Economy: Information and search in Peasant Marketing " *The American Economic Review* 68, no. 2(1978): 28-32.
- Hviid, M. "Relational Contracts, Repeated Interaction and Contract Modification." *European Journal of Law and Economics* 5(1998): 179-194.

- Kanagaretnam, K., et al. "Trust and reciprocity with transparency and repeated interactions." *Journal of Business Research* (2009).
- Klein, B., and K. B. Leffler. "The Role of Market Forces in Assuring Contractual Performance." *The Journal of Political Economy* 89, no. 4(1981): 615-641.
- Kreps, D. *Game Theory and Economic Modeling* Newyork: Oxford University Press, 1990.
- Lyon, F. "Trust, Networks and Norms: The Creation of Social Capital in Agricultural Economies in Ghana." *World Development* 28, no. 4(2000): 663±681.
- Robinson, J. A. and T. Verdier (2003). *The Political Economy of Clientelism*, Weatherhead center for international affairs, Harvard University



**Table.1. Observations from grain marketing in southern Ethiopia**

<b>Particulars</b>	<b>Values</b>
Percentage of sellers who have	
Price information prior to selling	76
Product information*	48
Both price and product information	41
Percentage of sellers who negotiate with	
More than one buyer before selling	71
More than two buyer before selling	40
More than three buyer before selling	16
Maximum number of negotiation	7
Transaction based on previous acquaintances	66
Clientelism (%)	
2006 survey	27
2009 survey	37
Mean duration of clientelism (years)	
2006 survey	5.02
2009 survey	3.6
Kinship with the buyer (%)	
2006 survey	23
2009 survey	13

*\* It includes information about the quality standard and the weight of the product*

**Table. 2. Descriptive statistics**

<i>Variables</i>	<i>Description</i>	<i>Non-clienteles</i>	<i>Clienteles</i>	<i>difference</i>
<i>Woreda</i>	1=Negele, 0=Wolayta	0.55	0.67	0.12
<i>age</i>	Household head age in years	48.51	41.46	-7.05**
<i>Education</i>	Years of education	4.12	3.97	-0.15
<i>Radio</i>	1=Own radio, 0= not	0.47	0.56	0.09
<i>Telephone</i>	1=Have access to telephone either private or public , 0= no	0.51	0.33	-0.18**
<i>Labor</i>	Number of adult labor in the household	3.97	3.36	-0.61*
<i>Bulk size</i>	The quantity bagged in recent sale in 100 kilograms	1.54	2.19	0.65*
<i>TLU</i>	Total livestock unit based on economic value	5.15	5.41	0.26
<i>House number</i>	Number of houses the household owns	1.41	1.51	0.1
<i>House type</i>	1= household owned iron roofed house , 0= if grass roofed house	0.48	0.54	0.06
<i>Market distance</i>	Household's distance to the nearest market in kilometer	8.02	8.50	0.48
<i>Town relative</i>	1=if the household have kin in town of the market place, 0= not	0.43	0.59	0.16*
<i>Maize-price</i>	ETB per kg	2.7	3.2	0.5
<i>Wheat price</i>	ETB per kg	4.1	4.6	0.5

\* Significant at 10%, \*\* significant at 5% and \*\*\* significant at 1%

**Table.3. Participation in clientelism (marginal effects and Z-values)**

<i>Explanatory variables</i>	<i>Probit models</i>			<i>Tobit estimates</i>
	A	B	C	
<i>woreda (d)</i>	0.207* (1.80)	0.274** (2.27)	0.399*** (2.80)	3.020*** (2.81)
<i>radio (d)</i>	0.106 (0.98)	0.091 (0.86)	0.048 (0.43)	0.585 (1.01)
<i>telephone (d)</i>	-0.273*** (-2.919)	-0.306*** (-3.088)	-0.404*** (-3.771)	-2.852*** (-3.84)
<i>education</i>	-0.030* (-1.786)	-0.033* (-1.932)	-0.041** (-2.432)	-0.206** (-2.20)
<i>age</i>	-0.012*** (-3.031)	-0.014*** (-2.930)	-0.017*** (-3.323)	-0.103*** (-3.61)
<i>labor endowment</i>	-0.027 (-0.993)	-0.02 (-0.691)	-0.02 (-0.649)	-0.171 (-1.07)
<i>Bulk size</i>	0.057** (2.30)	0.068** (2.41)	0.066** (2.43)	0.451*** (3.04)
<i>Total Livestock Unit</i>		-0.014 (-0.943)	-0.008 (-0.539)	-0.109 (-1.48)
<i>house type (d)</i>		0.207* (1.75)	0.239** (2.20)	1.371*** (2.17)
<i>house number</i>		0.012 (0.20)	0.021 (0.33)	0.226 (0.65)
<i>market distance</i>			-0.026* (-1.785)	-0.092 (-1.30)
<i>town relative (d)</i>			0.151 (1.38)	0.921* (1.67)
<i>N</i>	105	105	105	105
<i>aic</i>	128.09	129.91	127.45	234.76
<i>bic</i>	149.32	159.10	161.96	271.91
<i>Chi2</i>	22.51***	20.87**	26.78***	49.47***
<i>% correctly predicted*</i>	74.29	75.24	76.19	

(d) Marginal for discrete change of dummy variable from 0 to 1, \* p<0.10, \*\* p<0.05, \*\*\* p<0.01  
\*the prediction is both for the participant and non-participant

**Table.4. the effect of clientelism on farm-gate price**

Variables	Exogenous (D)		Endogenous (E)	
	Maize	Wheat	Maize	Wheat
Clientelism	0.623* (0.37)	0.699* (0.36)	1.427** (0.63)	1.913*** (0.67)
woreda	1.500*** (0.4)	3.513*** (0.65)	1.696*** (0.37)	3.706*** (0.5)
Bulk size	0.141 (0.09)	0.153* (0.08)	0.069 (0.09)	0.114 (0.07)
_cons	1.356*** (0.4)	0.451 (0.67)	1.216*** (0.37)	-0.066 (0.53)
r2	0.378	0.467	0.41	0.6
N	49	49	54	55

## Getaw Tadesse



Department of Economics  
and Resource Management  
Norwegian University of  
Life sciences

P.O.Box 5003  
N-1432 Ås, Norway  
Telephone: (+47) 64965700  
Telefax: (+47)64965701  
e-mail: [ior@umb.no](mailto:ior@umb.no)  
<http://www.umb.no>

ISSN:1503-1667  
ISBN: 978-82-575-0926-2

Getaw Tadesse Gebreyohanes was born in Minjar, Ethiopia, in 1973. He holds a BSc degree in Agricultural Economics from the then Alemaya University of Agriculture (AUA), Ethiopia, in 1995. He also holds an MSc degree in Development and Resource Economics from the Norwegian University of Agriculture (NLH), Norway, in 2003. He was Lecturer in Hawassa University before joining UMB for PhD study.

This PhD thesis comprises five chapters including an introduction and four separate papers. The overall objective of the thesis is to evaluate the performance of agricultural commodity markets in Ethiopia. Economists have long acknowledged the role of a properly functioning market in increasing productivity and enhancing food security. However, how to make markets work for everybody remains the concern of researchers and policymakers. In an attempt to identify market improving strategies, four separate studies are conducted. The studies apply an optimal mix of theoretical and empirical methods to derive relevant policy implications. The first study evaluates the effect of food aid on local food prices using partial equilibrium model and seemingly unrelated regressions. The study confirms that incoming food aid in Ethiopia is depressing commodity prices both in food deficit and surplus areas. The depressing effect is, however, higher for tradable commodities than non-tradable. The effect is also higher when food aid is shipped during surplus periods rather than during true-deficit periods. The second study evaluates the effect of speculation on price dynamics using the rational expectation theory and threshold-switching regression. The study indicates that commodity markets in Ethiopia are responsive to speculations. Speculative behaviors of traders and farmers appear to cause a structural break in the price formation process. The third paper applies principal-agent model and multinomial-switching regressions to examine the impact of interlinked contracts on smallholder's market integration. This study concludes that interlinked contract that applies discretionary pricing motivates smallholders better than interlinked contract that uses collective bargaining with uniform pricing. The fourth paper assess the role of information uncertainty in explaining smallholders' decision to engage in clientelism using repeated game model and binary estimation methods. The major conclusion drawn from this study is that lack of well-established market information system explains the emergence of relational market transactions. These transactions are payable in the short-term but may jeopardize the competitiveness of commodity markets in the long run.

Prof. Atle Guttormsen and Prof. Gerald Shively were the advisors.

