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Feeding Africa's cities: The case of the Supply Chain of Teff to Addis Ababa

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Abstract

Urbanization is quickly increasing in Africa, raising important questions on how food value chains to cities function and what the implications of urban growth are for the local food trade and farm sector. We study the rural–urban value chain of teff in Ethiopia, by value its most important staple value chain. Relying on unique large-scale surveys at different levels in this value chain, we find—in contrast to conventional wisdom—that value chains are relatively short and that average farmers obtain a high share, of about 80 percent, of the final consumer price in the major terminal market, Addis Ababa. We further find that producer prices decline in line with transportation costs the further farmers live from the city, that seasonal price movements are rather small, and that average stock release by farmers is smooth over the year.

Keywords: agricultural transformation, teff, value chains, Ethiopia

"…Africa could produce enough food to feed itself; alas, too few subsistence farmers get a chance to sell their produce (and usually get less than 20 percent of the market price)."

The Economist, March 2nd- March 8th, 2013, p.9, in Leaders, "Aspiring Africa".

1. Introduction

The importance of cities is rapidly growing. It is estimated that more than half of the world population was living in cities in 2010, up from 30 percent in the 1950s. Urbanization is rapidly increasing in Africa as well: the urbanization rate is projected to be as high as 60 percent by 2050 (UN Population Division 2010) and there are increasing concerns by local policy makers on the increasing dependence of African cities on imported foods.[1] This dependency on imports is often blamed on uncompetitive local value chains (e.g. Rakotoarisoa, Iafrata, and Paschali 2011).

However, few studies have looked in a scientific way at the functioning of domestic food value chains in developing countries, and especially so in Africa. This lack of research leads to a debate that might not be well informed.

Based on an innovative survey design involving detailed primary surveys at different levels in the value chain from major production areas to a major urban center, we analyze in this paper the value chain structure, price formation, and marketing behavior in rural–urban staple food value chains in Ethiopia. In particular, we study teff being marketed from the most important production zones (representing 42 percent of the commercial surplus nationally and more than 90 percent of the supply to Addis Ababa) to the biggest city in the country, Addis Ababa, estimated officially to be home to 4 million people but likely much larger, and therefore among the bigger cities in Africa. We find that rural–urban value chains are relatively short. Consistent with this structure, we find that margins in these major commercial domestic staple value chains are surprisingly small and that the average share of the final retail price that the producer receives reaches about 80 percent. We further find that producer prices over space decline in line with transportation costs, releases by the producer of teff stocks in storage over the year is rather smooth, and distress sales are of minor importance.

1 Christiaensen and Devarajan (2013) find that since the mid-2000s, Africa converted from a net exporter of agricultural products to a net importer. Much of the growth in imports concerns staples for the rapidly expanding urban populations. They state that "except for wheat, which is a temperate-zone crop, these are all products in which Africa enjoys a comparative advantage" (Christiaensen and Devarajan 2013, 185).

Our findings are in contrast with a number of common perceptions on food value chains in developing countries. First, as shown in the quote above, it is often assumed that farmers only obtain a small share of the final retail prices.[2] However, few systematic recent reviews based on representative surveys have been done on this issue.[3] Second, another perception is that food value chains are characterized by many layers of traders between producers and consumers, leading to inefficiency (e.g. Masters 2008; World Bank, 2009). For example, the World Bank in its flagship report on agriculture states that "in agriculture-based and transforming countries … layers of intermediaries are common in the marketing of food staples and other agricultural commodities" (World Bank 2008, 119).[4] Third, smallholder farmers are often perceived to be driven to distress sales just after harvest when prices are low (e.g. Grootaert, Oh, and Swamy 2002; Poulton et al. 2006; Jayne et al. 2010).

There are, however, a number of problems with the evidence base on the functioning of these staple food markets. First, the common practice in food value chain analysis is that often only uses anecdotal or qualitative evidence and it does not rely on reliable and representative surveys (e.g. Webber and Labaste 2009; Nang'ole, Mithöfer, and Franzel 2011; World Bank 2009). Moreover, there is often a lack of reliable data at a larger scale in Africa (Jerven 2013) making it difficult to make credible inferences on the state of agricultural marketing. Second, in the case that studies were fielded, they typically focus on randomly selected farmers, with the disadvantage that the selected farmers might be of relative less importance in major food supply areas and might thus not present a representative picture of the farmers that effectively participate in value chains of specific food crops (World Bank 2009).

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2 While producer shares are an imperfect indicator of marketing performance – e.g. Tomek and Robinson (1972, p.115) caution that "there is a tendency to use the number to indicate the 'well-being' of farmers or to indicate that marketing costs are 'too high'. In fact the farmer's share statistic has little to say about either problem" - , we will use it in some of our analysis given that it is commonly used in the debate.

3 Ahmed and Rustagi (1987) compared producer shares in final retail prices in Asia and Africa in the 80s. They show that producer shares in final consumer prices were as high as 75 to 90 percent in Asia but as low as 35 to 60 percent in Africa. Gollin and Rogerson (2010) find in Uganda that farmgate prices for cassava and maize are often significantly less than half of wholesale prices, across many crops and regions. The World Bank (2008) estimates the share that farmers receive of the final retail price of maize in Ghana at 56 percent.

4 Mattoo, Mishra, and Narain (2007) and Landes and Burfisher (2009) argue that in the case of India most agricultural trade is mediated by a large number of intermediaries which not only inflate prices but this system also takes time to move products from farmers to consumers, leading to large transit costs. Trienekens (2011) argues that local value chains in developing countries are long, in contrast with modern supermarket channels and export markets. Staple cereal chains are often found to be long and complex in Africa, as documented in Ghana (World Bank 2008) and Ethiopia (Rashid and Negassa 2011; Rashid and Minot 2010).

The impact of these common perceptions is not to be underestimated as government and other stakeholders often intervene in these markets assuming that they are not working well. Some examples illustrate this. First, cooperative marketing is often promoted on the assumption that it increases bargaining power of farmers, solves some of the economies of scale issues that farmers face in the market, and thereby will improve the prices smallholders receive for their produce (Bernard et al. 2010; CTA 2012; DFID 2004). Second, modern commodity exchanges are increasingly been established in Africa to improve objective grading, transparency, as well as competition in agricultural markets (Gabre-Madhin 2012). Third, credit schemes (e.g. warehouse receipt systems or communal storage schemes) are being promoted to reduce the impact of distress sales (World Bank 2012; DFID 2004). In such schemes, farmers use their unsold produce as collateral to obtain credit to meet immediate expenditures, enabling them to hold onto their produce to sell later in off-season when they will benefit from higher prices.

The findings from our research point to some important policy implications. First, given the lack of good data on food value chains and the often fast changes that are happening in such value chains globally (e.g. Reardon et al. 2012), more effort in the collection of reliable updated primary data is required. Such data might better inform the policy debate on the extent of different constraints in the functioning of these food value chains and on ways that policies can address them. Second, policies aimed at improving market efficiencies—such as stimulating increasing involvement of cooperatives in output marketing (CTA 2012), the establishment of modern exchanges (Francesconi and Heerink 2010; Gabre-Madhin 2012), or warehouse receipt systems (World Bank 2009, 2012)—should be carefully assessed as to where exactly these policies are expected to improve market functioning, especially of staples, and what the expected benefits would be compared to the costs.

2. Background and Data

Teff *(Eragrostis tef)* is a major staple food crop in Ethiopia, as measured by a number of indicators. In 2011/12, it was estimated that teff made up 20 percent of all the cultivated area in Ethiopia, covering about 2.7 million hectares and grown by 6.3 million farmers (CSA 2012). Compared to other cereals, teff is considered a lower risk crop as it can withstand adverse weather conditions and it can be stored for longer period without major impacts (Fufa et al.

2011). Teff is also valued for its fine straw, which is used for animal feed as well as mixed with mud for building purposes.

On the consumption side, teff's grain is mainly used for making *enjera*, a spongy flatbread, the main national dish in Ethiopia (as well as Eritrea). Teff is more readily eaten by urban than by rural households. Berhane, Paulos, and Tafere (2011) show, relying on national household consumption data, that urban consumption per capita is as high as 61 kg per year. This compares to 20 kg per capita per year for rural areas. They further illustrate the high income elasticity for teff, evaluated at 1.10 in urban areas and 1.20 in rural areas. Teff is therefore an economically superior good that is relatively more consumed by the rich than by the poor. The lower consumption by the poor is also partly explained by the high prices of teff which are typically twice as high as the cheapest cereal, i.e. maize (Minten et al. 2014).

An important factor in any food market is quality. The most widespread distinction used in the teff value chain relates to the color of the grain. The distinction between *magna* ("superwhite"), white, mixed, and red teff is widely used and well known by farmers as well as traders, and we will therefore use it as a measure for quality throughout this paper. Teff quality is often evaluated by origin as well and while the quality of teff is also judged by a number of other factors, such as aroma, texture, and nutritional quality, these are often difficult to measure objectively.

The purpose of the study is to understand how the rural–urban teff value chain functions. We rely on data from major teff producing areas and follow the value chain from there to Addis Ababa, the capital of Ethiopia. To get at this information, two types of activities were organized. Interviews were conducted with key informants in the value chain in September and October 2012. That information was used to design questionnaires for each level in the value chain.
These questionnaires were then fielded at the end of 2012. The implemented instruments included surveys upstream in the value chain with teff producers and communities, midstream with rural and urban wholesalers and truckers, and downstream with cereal shops, mills, and cooperative retail. 1,800 primary survey interviews were conducted in total.

Upstream in the value chain, we selected 1,200 teff farmers. The selection of these farmers involved several steps. First, the five zones with the highest commercial surplus of teff in the country were chosen. In 2011/12, these five zones combined represented 38 percent and
42 percent of the national teff area and commercial surplus, respectively. Second, within each

production zone, the *woredas* were ranked from smallest to largest producer (in terms of area cultivated). We then divided the *woredas* in two, the less productive (cultivating all together 50 percent of the area) and the more productive *woredas* (cultivating all together 50 percent of the area). Two *woredas* were randomly selected from each group. Third, a list of all the *kebeles* of the selected *woredas* was obtained. Two *kebeles* were randomly chosen from the top 50 percent producing *kebeles* and one from the low 50 percent producing *kebeles*. Fourth, a list of all teff producers in the preceding season in the selected *kebeles* was then made. They were ranked from small to large teff producers (based on areas cultivated). We then divided the farmers in two groups, the small production (cultivating all together 50 percent of the area) and the large production farmers (cultivating all together 50 percent of the area). Twenty farmers were then selected: 10 from the small production and 10 from the large production farmers. In total, 240 farmers were interviewed per zone.[5] Data on teff areas at the *woreda* and *kebele* level were collected from relevant representatives from the Ministry of Agriculture.

Midstream, the following strategy was followed. First, 40 rural wholesalers were interviewed in each rural zone. For each *woreda*, the major trading town or temporary wholesale market used by farmers in that *woreda* was selected. A census of all traders in that market/town was then made. As the focus of the study was to understand the value chain from rural areas to Addis Ababa, ten traders that ship teff to Addis Ababa were then randomly selected from this list in these towns/markets. Four such towns/markets were selected for each zone. Second, in Addis Ababa, 75 wholesale traders and brokers were interviewed in total. One-third was interviewed in the Ehil Beranda wholesale market and two-thirds in the Ashwa Meda market, reflecting the relative shares of teff wholesale marketing for Addis Ababa that each market handles. Twenty-five wholesalers were randomly selected in Ehil Beranda (13 without and 12 with shops) and 50 (25 with and 25 without shops) in Ashwa Meda. Ninety truck drivers transporting teff were also interviewed (one-third in Ehil Beranda and two-thirds in Ashwa Meda).

5 To understand to what extent the farmers that were surveyed are different compared to other farmers, we run first a probit comparing other farmers to teff farmers and then comparing teff famers from our survey to all teff farmers in the same surveyed zones. For this exercise, we used the Ethiopian Rural Socio-economic Survey (ERSS), representative at the national level, and fielded with 4,000 households in 2011/2012 in rural areas and small towns across Ethiopia. The right-hand variables in the probit are age, gender, marital status, and religion of the head of household, size of household, distance to an all-weather road, land owned, and zonal dummies. First, we find that teff farmers own significantly more land than other farmers. Teff farmers are also characterized by significantly larger households as well as a higher percentage of male-headed households. This might be related to the high labor requirements for teff production. Second, when comparing the teff farmers from our survey with those from the ERSS in the same zones, we find no significant differences on relevant variables.

Downstream, we relied on a stratified sampling scheme to select a representative sample of teff retail shops in Addis Ababa. Based on the map of the city, we created five geographical strata with two neighboring similar sub-cities in each stratum. We then randomly selected one sub-city from each stratum, giving us in total five sub-cities to work with. Next, we collected information from the city's Trade and Industry Office, which provided us the complete lists of teff outlets in each sub-city. We then randomly selected outlets to be interviewed. First, all the consumer cooperatives selling teff were surveyed at the sub-city level. Second, in each selected sub-city, four *kebeles* were selected randomly. In each selected *kebele*, all the flour mills were surveyed and five cereal shops were randomly selected and surveyed. In total, 282 retail outlets were interviewed.

Table 2.1 gives an overview of the sample and some basic characteristics of the different value chain agents. The teff value chain is dominated by men. Fifteen percent of the retail outlets are managed by women but their contribution to other functions in the value chain midstream is limited. Ninety-five percent of the rural wholesalers and all the truck drivers and urban wholesalers are men. Female-headed teff farming households make up 5 percent of our sample. The level of education is slightly higher for value chain agents midstream, with average years of education between 8 and 9 years. It is lowest for the farmers at 5 years. The average years of experience in the teff business is around 8 and 10 years for all agents while truck drivers have an average experience of 6.5 years.

Table 2.1—Sample set-up and basic descriptive

3. Description of the teff Value Chain

3.1. Marketing Upstream

Table 3.1 presents some basic descriptives of teff marketing upstream, i.e. by farmers. An average teff producer sold 507 kg in the year prior to the survey. The majority of this teff sold was white, making up two-thirds of all teff sold, while the quantities of mixed and red teff sold are rather small. We find that 36 percent of all the produced teff is sold but that there are large differences between different qualities. While 58 percent of the production of *magna* ("superwhite") teff is sold, this is as low as 13 percent for red teff.

The number of marketing transactions by these farmers is rather limited. The median is 1 and the average is 1.75. Farmers were asked for each marketing transaction to give details on the specifics of that transaction. The majority of the sales are to traders at local wholesale markets or to traders with a fixed shop, often in regional markets. Farmers traveled on average 1.5 hours to get to the place of sales and on-farm sales or sales in the village are therefore relatively less important, in contrast with other countries in Africa (Chamberlin and Jayne 2013). Direct sales to consumers make up 7 percent of all transactions. Sales to cooperatives or government institutions (such as the Ethiopian Grain Trade Enterprise) are rather limited: they make up less than 1 percent of the sales transactions. While cooperatives are very important in input distribution in Ethiopia, they are not a significant participant in cereal output markets (see also Minten et al. 2014).

An average sales transaction concerns 300 kg of teff for a value of 3,776 Birr (or about 200 USD). In 84 percent of the sales transactions, this was handled by a male member of the household. Inter-linked transactions with traders are of very little importance upstream. Ninety-nine percent of the transactions were paid immediately and in cash. In only 2 percent of the transactions did the farmer receive input advances from the buyer. This low level of advances and tied credit in staple food markets has also been found elsewhere (Reardon et al. 2012).

Distress sales, usually immediately after harvest, are presumed to be important in this type of agricultural markets (Fufa et al. 2011; Grootaert, Oh, and Swamy 2002; Poulton et al. 2006).[6] We use two indicators as a measure of distress in teff marketing. For each sale transaction, farmers were asked to indicate if they would have sold teff at that time if the price of teff would have been 10 percent lower. If they said yes, a follow-up question was asked if they would have sold at a price that would have been 50 percent lower. While the positive answers to these questions can be used as measures of distress sales, we recognize that these indicators are crude, given their hypothetical nature as well as their retrospectiveness, and should therefore be used with caution. Using these indicators, it is estimated that 19 percent of the transactions were sold in distress and 10 percent in extreme distress (Table 3.1). In contrast, in 71 percent of the

6 "… [teff] farmers usually sell their produce immediately after harvest, resulting in high supply in those seasons, thereby leading to lower farm gate prices. In almost all cases of the focus group discussions conducted, the study noted that the immediate selling behavior of farmers is the result of their immediate liquidity requirements." (Fufa et al. 2011, 26)

transactions, farmers would not have accepted at the time of sales a lower price of that order of magnitude.

Table 3.1—Characteristics of marketing transactions by teff farmers

3.2. Marketing Midstream and Downstream

Table 3.2 presents marketing descriptives of value chain agents midstream and downstream. Their yearly teff turnover varies between 36 ton for urban retailers to almost 700 ton for urban wholesalers and brokers. Few of the traders report to be involved in long-time storage. The traders were asked details on the different types of services that are provided to suppliers and clients. The data indicate seemingly important transaction costs between different layers of the value chain, especially related to correctly assessing quantity and quality. Weighing happens at every level, at the time of purchase as well as sales. Quality assessments are also done for each transaction. This is usually done through visual checks or by rubbing the teff. Some of the agents report to even chew the teff to determine its quality (47 percent, 28 percent, and 20 percent of the urban traders/brokers, rural traders, and retailers respectively).

Family, kin, and ethnic relationship are often presumed to be important in agricultural trade (Gabre-Madhin 2001; Fafchamps and Minten 1999). Table 3.2 shows that urban brokers/traders work with a rather limited number of suppliers—seven on average over a 12 month period—and that they procure almost two-thirds of their supplies from the zones that they are originally from. This suggests tight, often family, networks at that level. The fact that traders purchase mostly from home networks might suggest information asymmetries that might create costly market frictions for those outside this network (e.g. Hoffman and Gatobu 2014). On the other hand, only 7 percent of the retailers work with suppliers that are originally from the same zones as theirs.
Questions were further asked on the importance of credit and advances. In contrast with the farm level, credit is more prevalent in the value chain midstream and downstream, often explaining the prevalence of these kin relationships in business (McMillan and Woodruff 1999). While few of the rural traders pay their suppliers on credit, this is much more important for urban wholesalers (60 percent) and urban retailers (45 percent). However, the credit is mostly of short duration. The average duration varies between 7 and 17 days. The share of traders that are paid on credit by clients is high as well. Advances are sometimes given to ensure supplies—

20 percent of the urban retailers reported giving advances. However, no urban traders reported providing advances.

Table 3.2—Descriptive of marketing agents

4. Structure and Price Formation

4.1. Structure of the Value Chain

To get at the structure of the teff value chain, rural and urban wholesalers and urban retailers were asked from whom they obtained supplies (and to whom they sold). The importance of each type of seller in total supplies was asked for each three-month period over the 15 months prior to the survey. This procurement information at each level allows us to deduct the prevalence of different value chain structures. We identify three main players in these value chains, i.e. the farmer-trader (FT) or rural assembler who operates in the village, the rural trader (RT) who operates on rural markets or in regional towns, and the urban trader (UT) or broker who operates on urban markets. We categorize the different value chains by the number of nodes between the urban retailer and the teff farmer.[7] Based on procurement responses of the different value chain agents, there are 18 possible chains from farmer to retailer, ranging from 0 nodes where retailers buy directly from farmers to 5 nodes (FT-RT-RT-UT-UT). For example, the FT-RT-UT supply chain represents a chain with 3 nodes where teff is sold to a farmer-trader (FT), who sells to a rural trader (RT), who then sells to an urban trader (UT).

Figure 4.1—Prevalence of different value chain structures between urban teff retailers and farmers

Figure 4.1 shows the surprisingly short supply chain that is commonly in place to ship teff to Addis Ababa. The cumulative line in the Figure illustrates that there are 0, 1, 2, 3, or more than 3 nodes in the teff value chain for 9.8%, 22.4%, 52.8%, 13.9%, and 1.0% of the teff sold by urban

7 To be able to make these calculations, some assumptions were made. First, simple averages over traders were calculated. No large differences were noted when weighted averages were used. Second, small alternative channels (such as cooperatives) were added to the rural traders' category. Third, some traders reported to purchase from other traders at the same level (1.3% of the rural traders; 9.8% of the urban traders/brokers). This was taken into account in the first stage and other sources of procurement were set proportionally in the second stage of procurement as in the first stage except for the trader of the same level, which was set to 0%. This assumption was needed to avoid indefinite loops; it however affected less than 0.5% of the supply chain allocation.

retailers.[8] In 85% of the cases, there are 2 trade nodes or less between retailers and farmers. The results are largely consistent if we triangulate the sales and procurement patterns at different levels. The most prevalent structure of the value chain from these major production zones to the urban city is from producer to regional trader to urban trader/broker to urban retailer (used in 48% of the teff supplies to Addis). In 28% of cases, urban retailers obtain their products directly in rural areas (bypassing the urban wholesale markets), making the value chain shorter. On the other hand, the value chain can also be longer, as rural traders procure 13 percent of their produce from rural assemblers or farmer-traders and 10 percent of the urban wholesalers/brokers obtain produce from other urban wholesalers/brokers.[9] However, in the most common case, there are three intermediaries found between farmers and urban consumers. The finding of such a structure is against conventional wisdom.[10]

4.2. Price Formation in the Chain

Prices were carefully collected at each stage of the value chain for each quality at the time of the survey. Information on the origin of the teff (i.e. the *woreda*) was asked as well as that is also often seen as an important determinant of quality, though difficult to verify objectively. Prices were asked from farmers at the time of the survey for their most common place of sale. While they might not have sold teff recently, farmers are often very well aware of current prices for the major crops that they grow. The advantage of this method is that there are fewer problems with recall. For traders, prices were asked for all qualities that they were selling that day or week.

One issue with the price comparisons throughout the chain is that the surveys were fielded at different periods. The rural surveys were fielded in November 2012 while the urban surveys were fielded in December 2012. To address this problem, a wholesale market price survey was

8 Note that eighty-six percent of what these retail shops sell is sold directly to consumers. The rest of the buyers are mostly enjera sellers and restaurants.

9 Ninety-two percent of all the teff sales by the interviewed urban wholesale traders was destined to Addis Ababa. While Addis Ababa was seen in the past as a clearing house for national cereal trade, i.e. the national cereal trade went through Addis Ababa as all major traders were stationed there (Gabre-Madhin 2001), this is seemingly less the case now than before. The larger agricultural marketing flows in the country, as well as improved communications, might have contributed to that change (Minten et al. 2014). Urban traders were also asked to indicate from which zone they procured teff. The five production zones where the producer surveys were fielded make up for 91 percent of all the teff coming to Addis Ababa. In our survey set-up, we thus captured well the major suppliers to Addis Ababa as well as end-users, rarely the case in surveys of food value chains.

10 Fufa et al. state "The teff value chain is fragmented and involves many players. Most farmers sell to assemblers individually, who then sell on to traders and wholesalers. Most teff is sold at harvest when prices are low." (2011, 2)

conducted where prices for different teff qualities and origins were carefully and consistently collected on a daily basis with a large number of traders in three urban wholesale markets during each of the periods. This information allows for an adjustment in price levels between periods and for a consistent comparison over the value chain. To do so, wholesale prices were regressed on weekly dummies and all prices were adjusted, depending on the week that prices were collected, by the coefficient from this regression, assuming that absolute margins stayed similar between these periods. Prices are consequently expressed in reference to wholesale prices of the first week of November (last week of *Tikimt*).

Using these prices, we run a regression of the following form where the price of teff is a function of the characteristics of the product, for example, through variety choices or through embedded services or locational characteristics. A simple model of the following form can then be run:

$$p_h = \sum_{k=0}^{N} \beta_{kh} \quad X^k_h + v$$

where p_h is the price of the product h, X^k_h is the quantity of the attribute k of the product h, β_{kh} the implicit price, and v a stochastic error term.[11] The results are reported in Table 4.1.

In a first specification, the price of teff is regressed on different "pooled" (i.e. prices from different surveys) value chain level (farm gate, rural market, urban wholesale market, with urban retail markets as the default) and quality dummies. The results show the consistency in price composition, with farmgate prices lower than rural market prices, rural market prices significantly below urban wholesale prices, and urban retail prices higher than wholesale prices. The results also show the significant quality premiums that are attached to different teff qualities, with the best quality (*magna* teff) being valued with an average premium of 419 Birr per quintal over the worst quality (red teff), representing a 25% higher price at the retail level. The coefficients from this specification illustrate that the share of the farmgate in final retail prices of teff are a high 78 percent to 84 percent, depending on the quality. When farmers sell on rural markets, where most of the farmer sales happen, shares are even higher. Half of the margin between farm gate and retailers consists of the margin between the village and urban wholesale markets. The urban distribution margin makes up for the rest.

11 As the purpose of the exercise is to understand price formation in the value chains from rural areas to Addis, we only include these producer prices where commercial surplus sold to Addis in the village as a whole was reported.

We further note strong price heterogeneity within a "level". For the producers, we note significantly different prices between farmgate and market prices. We also note significantly (as shown by an F-test) lower prices on rural markets for those reported by farmers compared to prices of traders that ship teff to Addis, as shown in specification 2. This is partly explained by the fact that most of the traders that ship to Addis are located closer to Addis than average farmers in our dataset. This is confirmed by the fact that when an interaction of reported rural market prices by farmers with a closeness to Addis dummy (along the median of the reported distance by farmers in our dataset) is included in the regression and when we test for differences between this interaction term and reported procurement prices on rural markets by traders, no significant differences are found (specification 3).

Table 4.1— Price regressions over the rural-urban teff value chain (price at time of survey; Birr/quintal)

On urban wholesale markets, a significant difference is found in the price that is reported by rural traders that sell there (the "procurement" price) and reported sales prices by brokers and urban traders on these markets. That difference is relative large (28 Birr/quintal) and significant as indicated by an F-test. The difference between these prices can partly be explained by transaction costs such as broker fees (an average of 6.5 Birr/quintal in our dataset) and loading and unloading costs (on average 2.8 and 3.1 Birr/quintal respectively; this is however only done if the buyer is located on the urban wholesale market). There is also the possibility of rents which are seemingly important in this specification. When we include *woreda* dummies as additional controls for quality, this difference disappears however and the finding of significant rents on these urban wholesale markets is not robust. Finally, we split the urban retail prices in three levels, those reported by mills (the default), by consumer cooperatives, and by cereal shops. While cooperatives have a negative coefficients indicating cheaper prices, these are however not significant at conventional statistical levels.

As we collected information on prices over time, over space, as well as in quantities sold by different farmers, this allows us to calculate the average producer share in the Addis Ababa retail price over the year of the survey. This is in contrast with the analysis presented above where we only used prices at the time of the survey. For this exercise, we use as the retail prices the

average price reported by the retailers for every two months for the four qualities over the 12 months prior to the survey. The producer prices are then divided by retail prices for the same period and for the same quality. For the calculation of prices, we weigh them by the quantity sold by particular producer as to represent the commercial value chain. Using this method, the average share of the producer in the final retail price in Addis Ababa—reflecting the share of the consumer price that went to the producer for the 12 months prior to the survey—is estimated to be as high as 79.4 percent. The median is evaluated at 79.2 percent. This calculation with different price collection methods thus confirms the order of magnitude that was found with the previous method.

Detailed data were further collected on teff production costs at the farm level. This allows us to calculate profits at that level. We find that despite the high shares of producers in final retail prices and the high absolute profits compared to the costs, farmers do seemingly not make very high profits per unit of time from the production of teff. It is estimated that monetary input costs make up 23% of the total value of output (Table 4.2). However, teff is a labor-intensive crop and little labor-saving mechanization is currently used. About 141 person-days are needed on average per hectare per production cycle, i.e. for preparation of the field until final harvesting and threshing. When average and median rewards per person-day are calculated, this amounts to 39 Birr/day and 23 Birr/day respectively (or 2.25 and 1.33 USD/day), barely above the international poverty lines that are commonly used (1.25 USD/day).[12]

While we lack good cost data at the trader level, we however have access to accurate transport costs. Transport costs make up 42 Birr/quintal on average or almost 69% of the price difference between rural and urban wholesale prices (taking as a reference specification 2), and only 3% of the final retail price (in the case of the most commonly traded white teff). The rest is rewards to traders' inputs, including search, personal travel, storage, licenses, bagging, weighing, quality and quantity assessments, and risk taking. Unfortunately, we lack accurate data to calculate rewards to these individual activities.

Table 4.2— Variable production costs and profits for teff farmers

12 Evaluated with the exchange rate at time of production, i.e. the end of the year 2011.

The average price composition picture is for the first week of November when overall prices are relatively high (as it is just before the new harvest). Producer shares will come down when prices are relatively low after the harvest period. Farmers that are further out obtain a lower share as well. The issues with temporal and spatial variation are discussed in more depth below, in sections 5 and 6 respectively.

5. Temporal Variation

Seasonality is important in most agricultural markets but especially in Ethiopia because of a short rainfall season, limited irrigation possibilities, and therefore often the reliance on one crop a year (Dercon and Krishnan 2000; Devereux, Sabates-Wheeler, and Langhurst 2012).[13] We look in this section at seasonality in price behavior, in storage, and in use of production, including sales. As for most agricultural crops in Ethiopia, teff production is characterized by significant seasonality. Crops are mostly planted in July and August while the major harvest periods is situated in the months of November and December.

Data were collected at the farm level on monthly storage, sales, and consumption of teff. Households were asked to carefully indicate in which months teff harvests were coming from the field and what the level of teff storage was at the end of each month. Monthly teff withdrawal for sales, consumption, or other uses from these stocks had to be noted as well. Enumerators and farmers were asked to ensure that inflow and outflow of teff stocks were consistent for every month. Figure 5.1 shows how these measures change over the year. The figure on the left illustrates the average smooth withdrawal of teff from peak storage after harvest (at about 800 kg per household in the month of March). This average storage level comes down to about 100 kg per household in November.[14] The graph also indicates strong differences between households. The lowest 25th percentile teff farmers does not hold stocks for three months while the 75th percentile holds continuously stock over the year, going up to 1 ton in the post-harvest period. We note however at each level smooth stock withdrawal, seemingly not associated with distress sales after harvest.

13 The existence of seasonality in prices and supply is not an indication per se of inefficiency. A number of authors (e.g. Williams and Wright, 2005; Benirschka and Binkley, 1995) have argued that seasonality in prices for a storable products should ideally reflect storage costs as well the opportunity costs of money in these settings.

14 Teff can be stored for relatively longer periods without quality loss and the graph suggests that some farmers indeed store across years seemingly using teff as a savings device.

The Figure on the right shows monthly sales, consumption, and stock changes. Stock changes are calculated by comparing monthly changes in stock position, i.e. positive values indicate a stock buildup while negative values signal stock release. This is calculated for the mean, median, the 25th, and the 75th percentile of storage levels in the household dataset. Stock buildup is happening during the months of November until March. Stock withdrawal is mainly done between March and October. Similar patterns - but different quantities - are noted for the average, median, and different percentiles withdrawal. Stock release is highest during the period of July–August (*Hamle-Nehassie*), also the month when the sowing of teff takes place. The main uses of teff production are consumption and sales.[15] Teff consumption increases immediately after harvest and stays stable over the year. It drops to half the level in the months before the harvest. As expected, we also note strong seasonal patterns in the sales of teff. Surprisingly, the peak of sales in our survey data is not immediately after harvest but it is a couple of months afterwards.

Figure 5.1—Seasonality in storage (left side) and average monthly use of Teff (right side)

To get at seasonal movements in prices, we rely on prices collected in the last ten years by the Central Statistical Agency (CSA) on the markets in the same five production areas that we surveyed as well as in the urban retail markets of Addis. Following the method of Aker and Fafchamps (2014), we regress the logarithms of real producer and consumer prices as well as the gross real margins on monthly, yearly, market, and quality dummies. The results in Table 5.1 show that the lowest prices are observed just after the harvest and threshing period (January–March) and the highest prices toward the end of the year (August–October). Over the period considered, retail and producer prices increased significantly by 9 percent and 14 percent respectively in the months of August–October compared to the post-harvest price. Similar seasonal price amplitudes have also been found in other studies (Rashid and Negassa 2011; Minten et al. 2012). Compared to other cereals in Ethiopia, teff has a similar seasonal price movement as wheat (Minten et al., 2012). However, sorghum (15%) and maize (25%) prices are characterized by larger amplitudes, likely driven by relatively more difficulties in storage for these crops.

15 Sales and consumption are the most important uses of teff production. They make up 46 percent and 33 percent, respectively, of total use of the production in the year prior to the survey.

We further test how gross margins – defined as the difference between urban retail and rural market prices - are affected by seasonality. Margins are slightly higher during the post-harvest period from January until March. Compared to this period, real gross margins decline by about 6% in the months from July to September. The higher prices in the beginning of the year might be partly driven by higher transport costs during the post-harvest period given higher demand for transport services during that period in rural areas (Minten et al. 2012).

Table 5.1—Seasonality effects in gross margins and prices (2001-2012)

6. Variation over Space

Transportation costs and remoteness matter enormously in agricultural markets in developing countries (Teravaninthon and Raballand 2009; Deichmann, Shilpi, and Vakis 2009; Fafchamps and Shilpi 2003; Gollin and Rogerson 2010). In this section, we study how teff transportation and marketing behavior differ over space between Addis Ababa and rural production areas. First, we look at the transport sector and analyze how teff is shipped from rural to urban areas. Second, we discuss how farmers' teff marketing is related to these transportation costs.

To better understand how the transport sector for agricultural products in Ethiopia works, a survey was implemented with truck drivers that ship teff from rural areas to Addis Ababa's wholesale markets, where they were interviewed. Truck drivers were asked about the characteristics of themselves, the owner of the truck, and about the type of trucks used. Detailed questions were also asked about the last roundtrip (coming from rural areas to Addis Ababa and leaving from Addis Ababa to rural areas). Note that in most of the cases, transport services are delivered to traders by specialized transport companies and that few of the traders operate their own trucks. In our sample, only 23% of the rural traders and 3% of the urban traders stated to operate their own trucks.

Table 6.1 presents some of the descriptive statistics. The average carrying capacity of a truck that ships teff to Addis Ababa is rather small, i.e. 5 ton. It has been used for about 10 years and its value is evaluated at about 0.5 million Birr (or about 25,000 USD). In only 10 percent of cases is the driver also the owner of the truck. Most of the businesses involved in the transport of teff are

small in size as the median number of trucks owned is one.[16] The average distance covered in the last trip was 228 kilometer. Twenty percent of the trucks drove on non-paved bad quality roads during the trip while 46 percent only drove on paved roads. The cost of transport is 18 Birr/quintal per 100 km (or almost 10 USD/ton per 100 km), significantly lower than recent estimates (24 USD/ton per 100 km) on the costs from primary to terminal markets (World Bank 2012). It might be that there is significant competition in these commercial agricultural areas, driving down costs compared to other areas in Ethiopia. On the trip to Addis Ababa, transporters transported goods for about two sellers - given the relatively small quantities sold by farmers, these are almost always traders - and they delivered goods to over three buyers on average. In 82 percent of the cases, a transport broker was used to find a load. Transport charges for the return trip to rural areas are similar to traveling to Addis Ababa. However, in one-quarter of the cases the truck was empty on the return, indicating that it is often more complicated to find goods to ship out of Addis Ababa than to Addis Ababa. This is possibly confirmed by the higher prices that brokers charge for finding loads for trips out of Addis Ababa.

Table 6.1—Descriptive of transport

To understand how distance traveled is related with transport charges in these settings, transport charges per quintal are regressed on different explanatory variables including distance but also the size of the truck, road quality, number of sellers and buyers, and the use of a broker. We include a quadratic term in the distance as to allow for potential curvature in the effect of distance. Two specifications were run, one including data for the trip to Addis Ababa only and a second one where data for the round trip—when mostly no teff is transported—are added as well. The results are shown in Table 6.2. Distance and the intercept—reflecting the fixed part of the transportation cost—are the only variables that come out significant in the regression. It is estimated that for every 100 km extra traveled, transport charges go up by about 13 Birr per quintal (about 7 USD per ton per 100 km).

16 The World Bank (2012) shows that different types of companies are active in the transport sector in Ethiopia, including private companies with large fleets, transport associations consisting of a group of private operators with a limited number of trucks, government operated public transportation companies, and enterprises and sole proprietors that involve one or more individuals owning and operating their own trucks. Our results indicate that the latter companies take care of most teff transport.

Table 6.2—Determinants of transportation costs by trucks (in Birr/quintal)

Assuming that transportation costs would be transmitted to farmers, this is supposed to show up in farm prices. Using local polynomial smoothing estimates, Figure 6.1 shows the relationship of the reported producer prices at the time of the survey with transportation costs to Addis Ababa. We note overall significant decreases in teff prices the farther that farmers are located from the terminal market. While at the time of the survey the share of the producer price in the final retail price of the most traded teff quality (the *white* variety) close to the city reaches over 90 percent, this drops to 80 percent for the most remote farmers. We further note strong variability in price levels for those villages that have to pay more than 120 Birr/quintal to ship teff to Addis. Price setting in these more remote settings is seemingly more driven by localized demand and supply parameters and isolated markets have been shown to be associated with higher price volatility (see e.g. Jacks, O'Rourke, and Williamson 2011).

Figure 6.1—Producer price of Teff by transportation costs to Addis Ababa

We further formally test the influence of transport costs on producer prices through a multivariate regression framework where we control for other confounding factors in price formation. We use as the dependent variable in this case the reported price that the farmer received in teff marketing transactions in the last 12 months prior to the survey. In a first short model, we regress prices on quality dummies and transport costs to Addis. In a second longer model, we control for place of sales, quantity sold, as well as the timing of sales on top of transportation costs to Addis Ababa. Standard errors are estimated after accounting for within cluster (*kebele*) correlations and possible heteroskedasticity. The results of the regression are shown in Table 6.3. They show how producer prices drop significantly with increasing transportation costs to Addis. We test through an F-test if producer prices drop as fast as transportation costs to Addis Ababa increase. In both cases, this hypothesis cannot be rejected, indicating that teff producer prices drop in line with transportation costs.[17,18] The results further

17 This is in contrast to results reported by Minten and Kyle (1999) in Zaire as well as Gollin and Rogerson (2010) in Uganda. They find that producer prices drop much faster, possibly linked with decreasing levels of competition and increasing risk.

18 A specification was also tried where woreda dummies were included to additionally control for quality. In none of the cases was the F-test significant.

show that prices at the farmgate are lower, but not significantly, than on markets and that farmers that sell larger quantities are usually able to negotiate higher per unit prices (e.g. Fafchamps and Hill 2005).

Table 6.3—Determinants of producer teff prices (obtained price for marketing transactions over the last 12 months; Birr/quintal)

While we find that producer prices vary significantly over space, other production and marketing measures show strong associations across space as well. Figure 6.2 (left side) shows how production and commercial surplus per teff producing household vary with transportation costs to Addis Ababa. We see the highest commercial surpluses achieved by farmers that face the lowest transportation costs. Commercial surplus decreases to almost zero for those farmers that are most remote; these farmers drop to subsistence levels. Measured as the difference between production and sales, consumption levels of teff per household show less variation over space.

However, the most remote farmers have slightly lower consumption levels of teff.[19] The right side of Figure 6.2 shows how the quantities of commercial surplus that are sold to traders that ship the product to Addis Ababa vary by transportation costs to Addis Ababa. As could be expected, we find a strong relationship. For those farmers that live close by, the majority of commercial surplus is sold to traders that ship to Addis Ababa. For farmers that live further out, they ship to other places or to other types of sellers or more importantly, they just sell less.

Figure 6.2—Commercial surplus and quantity sold to traders shipping to Addis by transportation costs to Addis

In Figure 6.3, we further illustrate, using local polynomial smoothing estimates, how input costs, the value of production, and rewards to labor in teff production change over space. Again, strong spatial patters are noted, as has been shown in other settings (Fafchamps and Shilpa 2003; Jacoby and Minten 2009). Monetary production costs per hectare – most importantly chemical fertilizer and seeds – are about three times as high in the least remote areas compared to the most remote ones. The value of output per hectare also shows a strong link with remoteness, driven by higher yields as well as higher output prices. It falls to half the level from the least to the most

19 Possibly illustrating the economic superior characteristics of teff as more remote households are often poorer (e.g. Jacoby and Minten 2009).

remote areas. To get at the profits at the farm level, the value of output is compared to monetary input costs (not including labor). Figure 6.3 shows how these rewards to labor inputs change over space. While rewards in half of the domain hover around 40 Birr/day, this drops quickly beyond that distance and rewards to labor fall to zero in the areas that are mostly subsistent and do not ship teff to Addis. The results therefore show strong heterogeneity in teff production and marketing practices and pay-offs, linked with location with respect to major terminal markets, as has been noted before (see e.g. Schultz 1953)

Figure 6.3—Profits and rewards to Teff labor by transportation costs to Addis

7. Conclusions

The increasing urbanization in developing countries raises important questions on how food value chains function and on how opportunities can be harnessed from these changes to allow for better food security for rural as well as urban poor. We look in this study in particular at the case of the rural–urban value chain of teff in Ethiopia, by value its most important staple value chain, relying on an innovative survey format. Surveys were fielded at each layer of the value chain from major production areas counting for 42 percent of national commercial surplus and for more than 90 percent of the supply to the main terminal market in Addis Ababa, the capital of Ethiopia and also its largest city. We therefore look at the functioning of the most important staple value chain in the country. Almost 1,800 primary survey interviews with producers, traders, truck drivers, and retailers were conducted for this study.

We find that these value chains are relatively unsophisticated. At the farm level, there are no interlinked transactions with buyers of the produce (often seen in other countries, especially in more developed value chains), the role of credit is minor, and most of the transactions are cash transactions. Midstream and downstream, due to lack of grading and standardization we see significant efforts in checking quality and quantity at the time of each transaction along the value chain. Overall however, value chains are short – in 85% of the cases, there are 2 trade nodes or less between retailers and farmers - and farmers obtain a relatively high share of the final retail price (on average 80 percent). The majority of the farmers would not have accepted a significantly lower price at their times of sales, indicating the relatively minor importance of

distress sales in farmers' marketing decisions. Producer prices decline in line with transportation costs, seasonal prices are relatively small and storage release is
smooth over the year. In contrast with common perceptions, commercialization in these major teff-producing areas of Ethiopia seems therefore fairly well organized and while there are areas for marketing improvement, these are not likely to lead to major reductions in consumer price levels or increases in farmer prices given the relatively small share of marketing costs.

Our results raise questions as to why they are in contrast to conventional thinking. Several reasons can be forwarded. First, the literature on value chain functioning is heavily dominated by case study research (e.g. Dawe et al. 2008; Hayami, Kikuchi, and Marciano 1999), often raising questions on the representativeness of findings.[20] Second, changes are quickly happening in these value chains, especially in these zones where much of the teff produced is marketed, driven by improvements in transport infrastructure, better communication, and increasing demand for food choice and quality in cities (e.g. Reardon et al. 2012). It is possible that research has not kept pace with these changes. Third, we studied a relatively un-sophisticated market where there is little value addition. The situation might be different for other products (Miller and Jones 2010). Fourth, we looked here at a case of cereals where assessment of quality and quantity is relatively straightforward, and losses in the value chain are relatively small. Value chains of root crops where assessments of quality and quantity are more complicated or of fruits and vegetables where perishability and losses are a more important issue might lead to a different structure and higher margins. Fifth, we studied a product that has a relatively high price in urban retail market. For example, the price of teff is on average double the price of maize (Minten et al. 2012). As such, even if the maize market in Ethiopia performs as well as that for teff, the share of the final retail price that maize producers receive will result in a different picture. Teff is also a major staple crop. The situation might be different for non-staples or for products where markets are thin. Sixth, the value and services that traders bring to the system are often not well appreciated. In the face of increasing or volatile food prices, traders are often blamed.[21] In consequence, their importance in the value chain may often be overstated. Seventh, differences in agricultural.

20 Such case study approach is seemingly often linked with budget and time constraints in value chain assessments as well as with the difficulty of implementing surveys over different value chain participants.

21 For example, India forbade forward trading on commodity exchanges for a number of crops as to control food inflation. The increasing global volatility in food prices has been blamed as well on extensive speculation, but disproven by some authors (Irwin, Sanders, and Merrin 2009).

marketing behavior in Ethiopia compared to other African countries, possibly driven by the widespread availability of donkeys, the high rural population density, and the storability of teff might be factors leading to differences with other crops and countries. Unfortunately, evidence is in general thin in these areas and the findings from this study call for further research on other crops as well as other countries.

Our findings also point to some important policy implications. First, given the difficulty in correctly assessing market functioning, policies aimed at improving market efficiencies—such as stimulating increasing involvement of agricultural cooperatives in output marketing, the establishment of modern exchanges, or warehouse receipt systems—should be closely examined to determine how and where these policies are expected to improve market functioning and what the expected benefits would be compared to the costs of their implementation. Second, increasing investments in road infrastructure to bring in more remote areas and the lowering of transportation costs through removal of barriers in investments (World Bank 2012) is shown to be linked to the prices that farmers receive as well as to rewards to labor and are therefore important to increase agricultural income of farmers. Third, if the objective of policy makers is to reduce consumer prices in urban areas, relatively more attention should be given to lower farm production costs given that these costs make up the biggest part of the final retail price.

Tables and Figures

Table 2.1

	Unit	Mean	Median	Standard deviation
Farmers				
Number of observations		1200	-	-
Gender head of household	share male	95.3	-	-
Level of education	years of schooling	4.6	4.0	2.9
Experience in teff business	years	9.6	10.0	1.5
Rural wholesalers				
Number of observations		205	-	-
Gender	share male	94.6	-	-
Level of education	years of schooling	7.9	9.0	3.9
Experience in teff business	years	9.5	8.0	7.8
Truck drivers				
Number of observations		90		
Gender	share male	100.0		
Level of education	years of schooling	9.4	10.0	1.8
Experience as truck driver	years	6.5	5.0	5.9
Urban wholesalers/brokers				
Number of observations		75	-	-
Brokers	share	65.3	-	-
Traders	share	64.0	-	-
Gender	share male	100.0	-	-
Level of education	years of schooling	8.7	8.0	3.4
Experience in teff business	years	8.9	7.0	6.7
Urban retailers				
Number of observations		282	-	-
Mills	share	83.3	-	-
Cereal shops	share	9.9	-	-

Consumer cooperatives	share	6.7	-	-
Gender	share male	84.7	-	-
Level of education	years of schooling	7.7	8.0	4.4
Experience in teff business	years	8.2	5.0	7.8

Source: Teff value chain surveys

Table 3.1

	Unit	Mean	Median	Standard deviation
Commercial surplus				
Teff sold per household, quantity	kg	507	250	1130
Teff, commercial surplus for producing households	%	36	33	26
Characteristics of marketing transactions				
Transactions per teff farmer for producing households	number	1.75	1.00	1.52
Type of buyer:				
Farmers	%	0.6		
Farmer-assembler (farmer trader)	%	5.2		
Assemblers from outside village	%	5.5		
At wholesale market: traveling trader going to Addis Ababa	%	17.5		
At wholesale market: traveling trader going elsewhere	%	16.3		
Trader with fixed shop, selling teff to Addis Ababa	%	29.8		
Trader with fixed shop, selling teff elsewhere	%	17.4		
Consumer	%	7.0		
Other (miller, cooperative, EGTE/government)	%	0.7		
Total	%	100.0		
Sale location:				
On the farm or home	%	3.1		
Trader shop (fixed)	%	60.3		
Local (weekly) market	%	34.7		
Other (roadside, cooperative, at mill)	%	1.9		
Total	%	100.0		
Travel time between departure and arrival sales location	minutes	92.0	80.0	65.3
Time spent at location of sale before sale	hours	0.9	0.5	1.0
Total quantity sold per transaction	kg	299	200	685
Type of teff sold:				
Magna	%	22.4		
White	%	60.3		
Mix	%	7.2		

Red	%	10.2		
Total amount received	Birr	3,776	1,800	18,082
Price received	Birr/quintal	1,065	1,000	232
Person that sold the teff	% male	84.0		
Payment in cash	%	99.6		
Input advances received from buyer	% yes	1.9		
Payment in cash and immediately	%	99.1	100.0	9.1
Farmer would have sold at 10% lower price at time of sale	% yes	19.5		
Farmer would have sold at 50% lower price at time of sale	% yes	10.1		

Source: Teff producer survey; Note: EGTE = Ethiopian Grain Trade Enterprise.

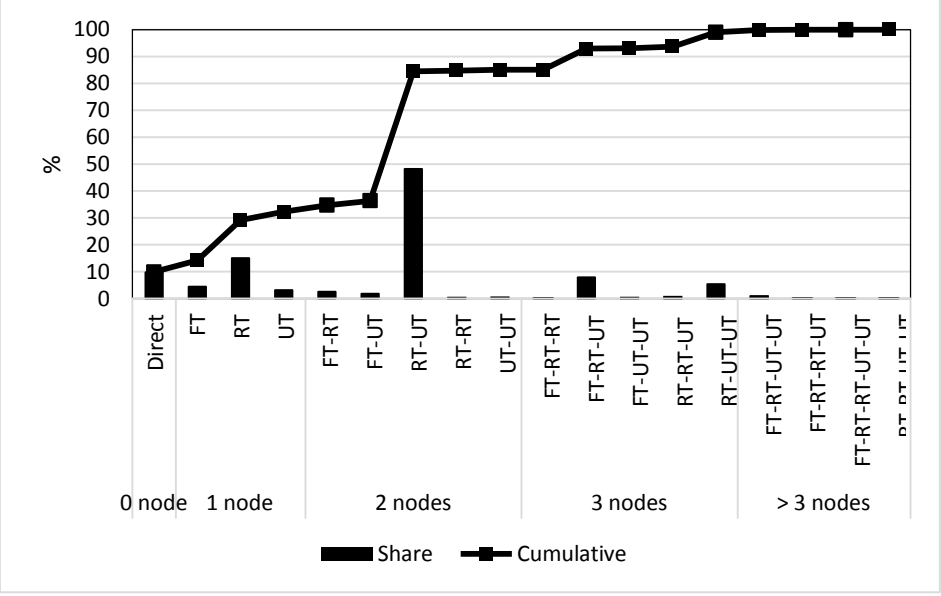
Table 3.2

		Rural traders		Urban traders/ brokers		Urban retailers	
	Unit	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
Value assets	1000 Birr	242.4	71.5	122.4	8.9	337.4	78.7
Yearly turnover of teff	ton	252.6	134.3	694.1	585.0	35.9	25.0
Do storage of teff for longer than a month	share (%)	13.7		21.3			
Services for suppliers							
Picked up teff in own/rented truck	share (%)	44.9		9.3		31.1	
Teff is weighed when bought	share (%)	93.2		40.0		98.4	
Teff quality is sampled when bought	share (%)	100.0		100.0		99.3	
If yes, visually checked	share (%)	97.6		100.0		100.0	
If yes, rubbed teff by hand	share (%)	68.3		88.0		62.3	
If yes, chewed the teff	share (%)	28.3		46.7		20.4	
Bags are provided to suppliers	share (%)	23.4		1.3		23.5	
Services for clients							
Deliver to clients	share (%)	91.7		46.7		67.1	
Grade and sort to sell to clients	share (%)	85.9		90.7		-	
Teff is weighed when sold	share (%)	94.6		100.0		99.2	

Teff quality is sampled when sold	share (%)	88.3		100.0		97.1	
Provide bags to clients	share (%)	71.7		98.7		25.2	
Credit							
Suppliers that are paid on credit	share	8.5	0.0	60.5	60.0	45.5	50.0
If yes, number of days before payment	(%)	11.1	7.0	6.7	5.0	16.6	15.0
Suppliers that were given advances	number	8.7	0.0	1.1	0.0	20.9	20.0
Clients that pay on credit	share (%)	39.0	25.0	47.9	50.0	30.2	30.0
If yes, number of days before payment	share	17.7	15.0	8.0	7.0	20.5	20.0
Clients that gave advances	(%)	2.5	0.0	0.0	0.0	4.3	5.0
Relationships							
Number of suppliers worked with in last 12 months				6.7	4.0		
Trader/broker is originally from Addis Ababa	number			15.0			
Procurement from trader's zone of origin	share (%)			65.0	100.0		
Broker that retailer works with is from same zone	share (%)					7.2	

Source: Teff trader surveys

Figure 4.1



Source: Teff trader surveys; Note: FT: Farmer-trader; RT: Rural trader; UT: Urban trader

Table 4.1

Level	Source	Unit	Specification 1 Coeff.	Specification 1 t-value*	Specification 2 Coeff.	Specification 2 t-value	Specification 3 Coeff.	Specification 3 t-value	Specification 4 Coeff.	Specification 4 t-value
Farmgate sales	Farm survey	yes=1	-265.6	**-23.02**	-267.4	**-23.06**	-304.5	**-16.49**	-228.1	**-20.80**
Farmgate sales interacted with nearby Addis dummy		yes=1					66.3	**2.92**		
Rural market procurement	Pooled	yes=1	-223.7	**-47.50**						
Rural market procurement	Farm survey	yes=1			-239.5	**-33.74**	-281.6	**-27.04**	-202.0	**-26.24**
Rural market procurement, interacted with nearby Addis dummy		yes=1					73.1	**5.74**		
Rural market shipping to Addis	Rural trader survey	yes=1			-208.8	**-42.25**	-208.4	**-42.22**	-175.7	**-31.59**
Urban wholesale market	Pooled	yes=1	-137.0	**-33.40**						
Urban wholesale market procurement	Rural trader survey	yes=1			-148.0	**-29.74**	-147.7	**-29.69**	-108.4	**-19.25**
Urban wholesale market sales	Urban trader survey	yes=1			-120.7	**-21.74**	-120.4	**-21.69**	-101.1	**-16.00**
Urban retail sales - mills (default)***	Urban retailer survey	yes=1								
Urban cooperative retail sales	Urban retailer survey	yes=1			-16.2	-1.58	-16.8	-1.63	-13.3	-1.16
Urban cereal shops sales	Urban retailer survey	yes=1			0.8	0.08	1.2	0.11	-5.8	-0.52
Magna teff (default)		yes=1								
White teff		yes=1	-95.0	**-19.60**	-91.9	**-19.04**	-83.7	**-17.44**	-67.7	**-14.74**
Mixed teff		yes=1	-201.5	**-37.59**	-203.1	**-37.76**	-198.8	**-37.55**	-171.6	**-31.50**
Red teff		yes=1	-419.0	**-64.07**	-419.3	**-64.04**	-413.1	**-63.72**	-385.7	**-60.48**
Intercept			1653.8	**404.46**	1654.2	**395.60**	1649.2	**398.32**	1442.2	**114.99**
Woreda fixed effects			no		no		no		yes	
Number of observations			3316		3316		3316		3251	
R squared			0.67		0.67		0.68		0.74	

			MSE				F-test if rural	
market price reported	F()	Prob>F	F()	Prob>F	F()**	Prob>F	F()	Prob>F
… by farmers is equal to reports by traders			15.77	**0.00**	0.00	0.99	11.74	**0.00**
F-test if reported urban wholesale procurement price … is equal to urban wholesale sales price			18.16	**0.00**	18.09	**0.00**	1.11	0.29

*: t-values in bold are significant at the 5% level; robust standard errors

**: rural market prices reported by the farmers in the least remote half of the sample

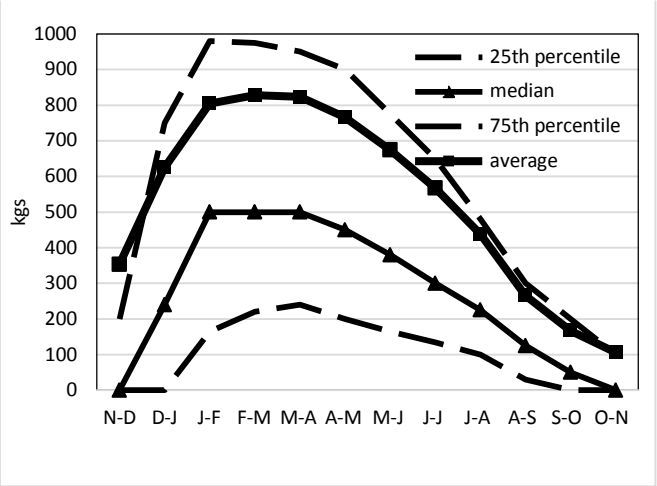
***: default in specification 1 is all urban retail; in other specifications, it is urban mills

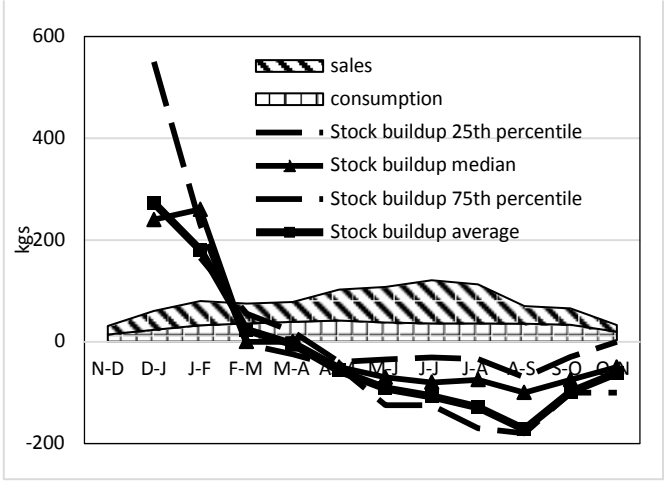
Table 4.2

	Unit	**Mean**	**Median**	**Standard Deviation**
Value of production	Birr/ha	11,407	9,600	6,901
Total monetary input costs	Birr/ha	2,674	2,387	2,922
Profit per hectare	Birr/ha	8,735	7,435	6,947
Total labor use	Person-days/ha	140.6	112.5	119.8
Rewards to labor	Birr/person-day	39.4	22.6	82.7

Source: Teff producer survey.

Figure 5.1





Source: Teff producer survey.

Table 5.1

		Producer (ln(Pp))		Retail (ln(Pr))		ln(Pr)-ln(Pp)	
	Unit	Coeff.	t-value*	Coeff.	t-value	Coeff.	t-value
Month (January=default)							
February	yes=1	-0.010	-1.47	-0.009	-0.41	-0.003	-0.43
March	yes=1	0.002	0.30	0.009	0.43	0.008	1.43
April	yes=1	0.022	**3.17**	0.007	0.33	-0.024	**-3.55**
May	yes=1	0.073	**9.67**	0.024	1.23	-0.050	**-6.83**
June	yes=1	0.116	**18.33**	0.072	**3.69**	-0.049	**-7.91**
July	yes=1	0.126	**17.85**	0.057	**2.90**	-0.060	**-8.94**
August	yes=1	0.119	**14.88**	0.077	**3.90**	-0.059	**-7.59**
September	yes=1	0.137	**19.05**	0.075	**3.68**	-0.067	**-9.69**
October	yes=1	0.086	**9.52**	0.086	**4.02**	-0.010	-1.13
November	yes=1	0.096	**12.59**	0.061	**2.69**	-0.040	**-5.49**
December	yes=1	0.067	**8.41**	0.032	1.34	-0.041	**-5.29**
Intercept		6.167	**197.09**	6.847	**203.16**	0.683	**22.25**
Quality dummies		yes		yes		yes	
Market fixed effects		yes		no		yes	
Year fixed effects		yes		yes		yes	
Number of observations		21972		396		21972	
R-squared		0.61		0.89		0.33	

Source: Central Statistical Agency; Prices deflated by the Consumer Price Index adjuste to 2012 prices)

*: robust standard errors; t-values in bold are significant at the 5% level

Table 6.1

	Unit	Mean	Median	Standard deviation
Characteristics of truck				
Carrying capacity	quintals	51.2	50.0	15.8
Age	years	9.7	7.0	14.1
Value	1000 Birr	500.0	500.0	261.9
Characteristics of truck driver				
Is also the owner	share (%)	10.7		
Characteristics of owner				
Gender	% male	98.1		
Education	years	8.8	10.0	3.8
Trucks owned	number	1.1	1.0	0.6

Characteristics of last trip		**To Addis Ababa**			**From Addis Ababa**		
		Mean	**Median**	**Standard deviation**	**Mean**	**Median**	**Standard deviation**
Distance	km	228	254	145	231	260	149
Road quality:							
- Only paved road	share (%)	45.6			46.6		
- Drove on non-paved road but good quality	share (%)	33.0			33.0		
- Drove on non-paved bad quality road	share (%)	21.4			20.4		
Time for travel between departure and arrival	hours	6.8	8.0	3.7	6.8	8.0	3.8
Time for unloading/loading/searching	hours	4.7	5.0	2.7	4.7	5.0	2.6
Time for whole trip	hours	-	-	-	22.6	23.3	8.0
Trucks which were empty	share (%)	0.0			25.2		
Capacity of truck used	%	94.9	100.0	13.9	81.0	100.0	35.3
Total value of good transported	1000 Birr	66.8	65.0	23.3	160.0	150.0	86.0
Transport payment	Birr/quintal	41.8	40.0	19.5	46.1	40.0	28.4
Number of sellers transported for	number	2.4	2.0	5.2	3.9	3.0	3.7
Number of buyers delivered to	number	3.4	4.0	1.3	4.0	3.0	3.4
Transport broker used	% yes	82.4			83.0		
Payment to transport broker	Birr	174	150	104	258	250	109

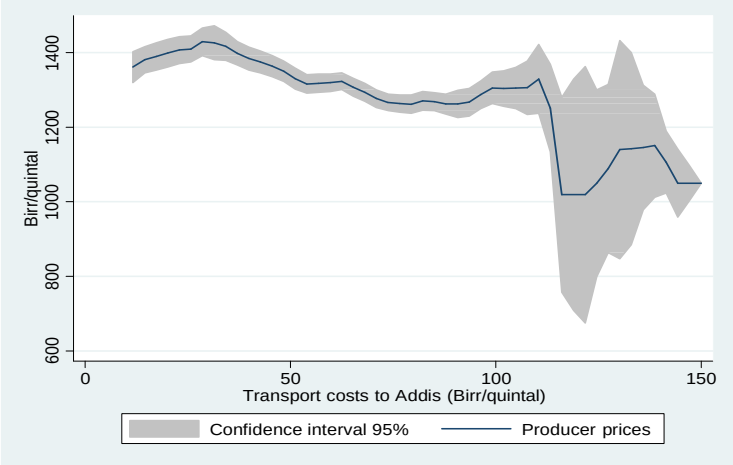
Source: Teff transporter survey.

Table 6.2

Explanatory variables	Unit	Trip to Addis Ababa only		Roundtrip	
		Coeff.	t-value*	Coeff.	t-value
Distance	100 km	13.23	**6.97**	12.00	**5.33**
Distance squared	100 km	-0.45	-1.63	-0.35	-1.37
Size of truck	quintals	-0.06	-0.81	-0.05	-0.96
Road quality (default only paved road):					
Drove on non-paved road but good quality	yes=1	-0.17	-0.05	3.99	0.84
Drove on non-paved bad quality road	yes=1	3.52	1.21	2.03	0.81
Number of sellers transported for	number	0.09	0.77	0.02	0.10
Number of buyers delivered to	number	0.32	0.37	0.03	0.47
Broker used	yes=1	3.55	1.56	-0.71	-0.22
To Addis Ababa	yes=1			1.87	0.53
Intercept		12.68	**3.15**	16.31	**2.56**
Number of observations		101		177	
R-squared		0.69		0.35	
Root MSE		11.46		19.37	

Source: Teff transporter survey; * t-values in bold are significant at the 5 percent level; robust standard errors

Figure 6.1



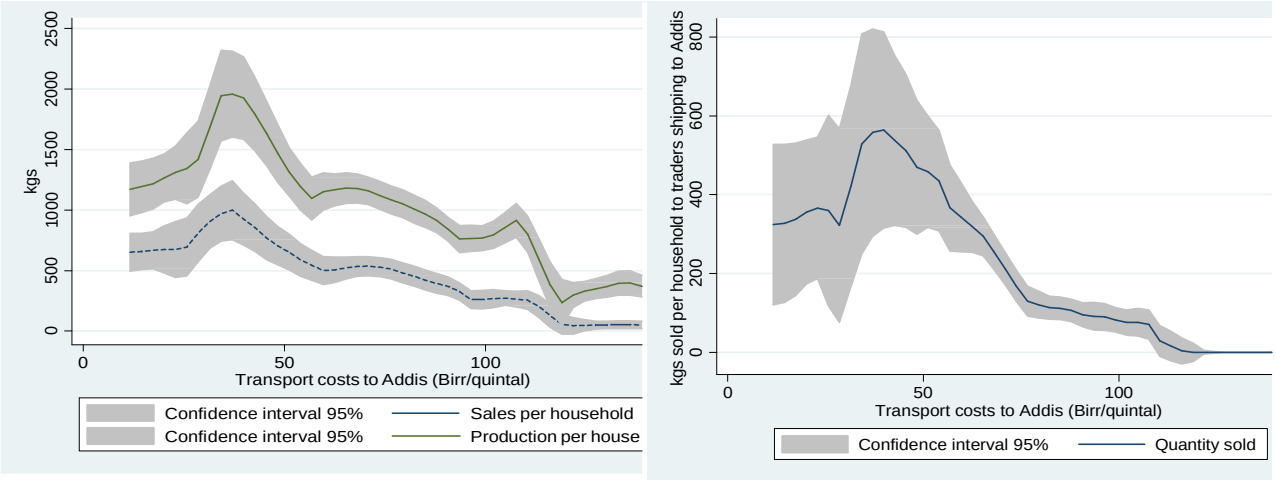
Source: Teff producer survey. Note: Local polynomial smoothing estimates with 95% confidence intervals

Table 6.3

	Unit	Short model Coeff.	t-value*	Long model Coeff.	t-value
Transport costs to Addis from kebele	Birr/quintal	-1.10	**-2.38**	-0.87	**-2.15**
Transport time to nearest market	log(minutes)			14.36	1.40
Quantity	log(quintal)			31.92	**4.32**
Farmgate	yes=1			-25.00	-0.62
Color teff (Magna=default)					
White		-49.82	**-2.41**	-53.00	**-3.01**
Mixed		-133.94	**-4.79**	-136.79	**-5.37**
Red		-268.14	**-10.17**	-279.81	**-12.77**
Intercept		1203.42	**37.08**	1329.10	**22.35**
Monthly dummies		no		yes	
Number of observations		2046		2046	
R squared		0.13		0.37	
MSE		216.69		185.16	
F-test if producer prices drop as fast as…		F()	Prob>F	F()	Prob>F
… transport costs to Addis increase		0.04	0.83	0.10	0.75

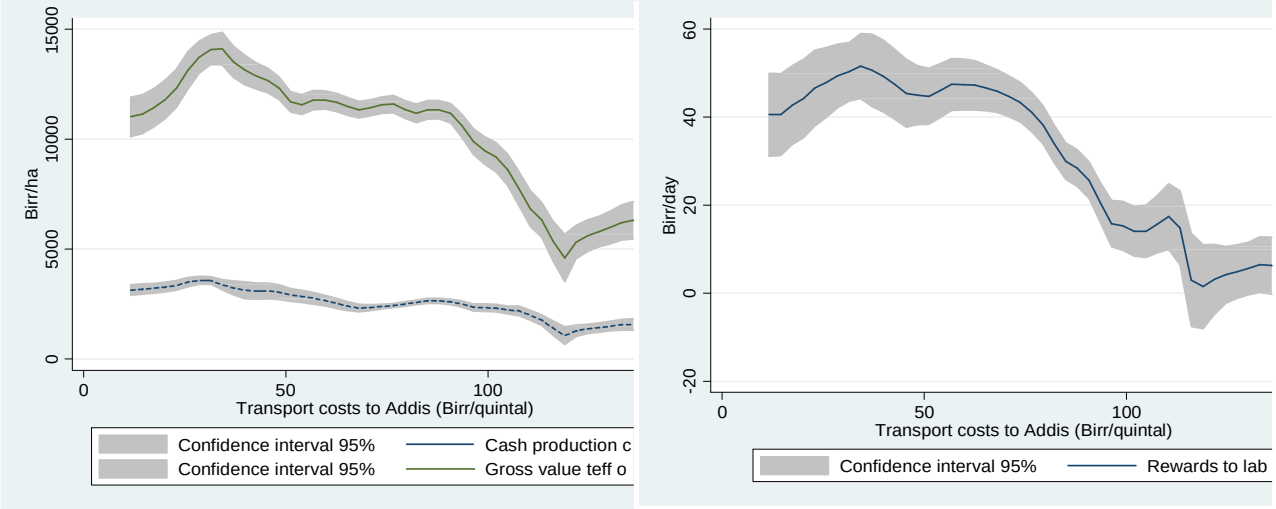
* Standard errors are estimated after accounting for within cluster (kebele) correlations and possible heteroskedasticity; t-values in bold are significant at the 5% level

Figure 6.2



Source: Teff producer survey. Note: Local polynomial smoothing estimates with 95% confidence intervals

Figure 6.3



Source: Teff producer survey. Note: Local polynomial smoothing estimates with 95% confidence intervals

References

Ahmed, R., and N. Rustagi. 1987. "Marketing and Price incentives in African and Asian countries: A comparison." In *Agricultural marketing strategy and pricing policy*, edited by D. Elz. Washington, DC: World Bank.

Aker, J.C., and M. Fafchamps. 2014. "How does mobile phone coverage affect farm-gate prices? Evidence from West Africa." *World Bank Economic Review*, Forthcoming.

Bernard, T., D.J. Spielman, A.S. Taffesse, and E.Z. Gabre-Madhin. 2010. *Cooperatives for Staple Crop Marketing.* IFPRI Research Monograph 164, Washington, DC: International Food Policy Research Institute.

Benirschka, M., and J.K. Binkley. 1995. "Optimal Storage and Marketing over Space and Time." *American Journal of Agricultural Economics* 77:512-524.

Berhane, G., Z. Paulos, and K. Tafere. 2011. *Foodgrain Consumption and Calorie Intake Patterns in Ethiopia*. ESSP II Working Paper 23. Addis Ababa, Ethiopia: International Food Policy Research Institute / Ethiopia Strategy Support Program II.

Chamberlin, J., and T.S. Jayne. 2013. “Unpacking the Meaning of ‘Market Access’: Evidence from Rural Kenya.” *World Development* 41: 245–264.

Christiaensen, L., and S. Devarajan. 2013. “Making the most of Africa’s growth.” *Current History* 112 (754): 181–187.

CSA (Central Statistical Agency). 2012. *Agricultural Sample Survey 2011/2012: Report on area and production of major crops.* Addis Ababa: Central Statistical Agency.

CTA (Technical Centre for Agricultural and Rural Cooperation). 2012. *Going to waste – missed opportunities in the battle to improve food security*. CTA Policy Brief 7. Brussels: Technical Centre for Agricultural and Rural Cooperation.

Dawe, D.C., P.F. Moya, C.B. Casiwan, and J.M. Cabling. 2008. “Rice marketing systems in the Philippines and Thailand: Do large numbers of competitive traders ensure good performance?” *Food Policy* 33 (5): 455–463.

Deichmann, U., F. Shilpi, and R. Vakis. 2009. “Urban Proximity, Agricultural Potential and Rural Non-farm Employment: Evidence from Bangladesh.” *World Development* 37 (3): 645–660.

Dercon, S., and P. Krishnan. 2000. “Vulnerability, seasonality and poverty in Ethiopia.” *Journal of Development Studies* 36 (6): 25–53.

Devereux, S., R. Sabates-Wheeler, and R. Longhurst. 2012. *Seasonality, rural livelihoods, and development*. New York: Earthscan.

DFID (Department for International Development). 2004. “Rethinking tropical agricultural commodities.” London: Department for International Development. http://dfid-agriculture-consultation.nri.org/summaries/wp10.pdf

Fafchamps, M., and B. Minten. 1999. “Relationships and traders in Madagascar.” *Journal of Development Studies* 35 (6): 1–35.

Fafchamps, M., and F. Shilpi. 2003. “The Spatial Division of Labour in Nepal.” *Journal of Development Studies* 39 (6): 23–66.

Fafchamps, M., and R.V. Hill. 2008. “Price Transmission and Trader Entry in Domestic Commodity Markets.” *Economic Development and Cultural Change* 56: 729–766.

Francesconi, G.N., and N. Heerink. 2010. “Ethiopian Agricultural Cooperatives in an Era of Global Commodity Exchange: Does Organizational Form Matter?” *Journal of African Economies* 20 (1): 153–177.

Fufa, B., B. Behute, R. Simons, and T. Berhe. 2011. *Strengthening the Teff Value Chain in Ethiopia*. Addis Ababa, Ethiopia: Ethiopian Agricultural Transformation Agency (ATA).

Gabre-Madhin, E.Z. 2001. *Market Institutions, Transaction Costs, and Social Capital in the Ethiopian Grain Market.* IFPRI Research Report 124. Washington, DC: International Food Policy Research Institute (IFPRI).

———. 2012. *A market for Abdu: Creating a Commodity Exchange in Ethiopia.* Occasional Essays Series. Washington, DC: International Food Policy Research Institute (IFPRI).

Gollin, D., and R. Rogerson. 2010. *Agriculture, Roads, and Economic Development in Uganda.* National Bureau of Economic Research Working Paper 15863. Cambridge, Massachusetts: National Bureau of Economic Research.

Grootaert, C., G. Oh, and A. Swamy. 2002. “Social capital, education, and credit markets: Empirical evidence from Burkina Faso.” In *Social capital and economic development*, edited by J. Islam, T. Kelly, and S. Ramaswamy, 85–103. Cheltenham Glos, UK: Edward Elgar Publishing.

Hayami, Y., M. Kikuchi, and E.B. Marciano. 1999. “Middlemen and peasants in rice marketing in the Philippines.” *Agricultural Economics* 20 (2): 79–93.

Hoffman, V., and K. Gatobu. 2014. “Growing their own: Unobservable quality and the value of self-provisioning.” *Journal of Development Economics* 106: 168-178

Irwin, S.H., D.R. Sanders, and R.P. Merrin. 2009. “Devil or Angel? The Role of Speculation in the Recent Commodity Price Boom (and Bust).” *Journal of Agricultural and Applied Economics* 41: 377–391.

Jacks, D.S., K.H. O'Rourke, and J.G. Williamson. 2011. "Commodity price volatility and world market integration since 1700." *Review of Economics and Statistics* 93 (3): 800-813.

Jacoby, H., and B. Minten. 2009. “On measuring the benefits of lower transport costs.” *Journal of Development Economics* 89 (1): 28–38.

Jayne, T.S., D. Mather, and E. Mghenyi. 2010. "Principal challenges confronting smallholder agriculture in sub-Saharan Africa." *World development* 38(10): 1384-1398.

Jerven, M. 2013. *Poor Numbers: How we are misled by African development statistics and what to do about it.* Ithaca, NY: Cornell University Press.

Landes, M.R., and M.E. Burfisher. 2009. *Growth and Equity Effects of Agricultural Marketing Efficiency Gains in India.* USDA-ERS Economic Research Report 89. Washinton, DC: United States Department of Agriculture – Economic Research Service (USDA-ERS).

Masters, A. 2008. "Unpleasant middlemen." *Journal of Economic Behavior & Organization* 68 (1): 73–86.

Mattoo, A., D. Mishra, and A. Narain. 2007. *From competition at home to competing abroad.* Washington, DC: World Bank.

McMillan, J., and C. Woodruff. 1999. "Interfirm relationships and informal credit in Vietnam." *Quarterly journal of Economics* (1999): 1285-1320.

Miller, C., and L. Jones. 2010. *Agricultural value chain finance: Tools and lessons*. Warwickshire: FAO and Practical Action Publishing.

Minten, B., and S. Kyle. 1999. "The effect of distance and road quality on food collection, marketing margins, and traders' wages: Evidence from the former Zaire." *Journal of Development Economics* 60 (2): 467–495.

Minten, B., D.C. Stifel, and S. Tamru. 2014. "Structural transformation of cereal markets in Ethiopia." *Journal of Development Studies* 50(5): 611-629.

Minten, B., S. Tamru, E. Engida, and T. Kuma. 2013. *Ethiopia's Value Chains on the Move: The Case of Teff*. ESSP Working Paper 52. Addis Ababa, Ethiopia: International Food Policy Research Institute / Ethiopia Strategy Support Program II.

Nang'ole, E.M., D. Mithöfer, and S. Franzel. 2011. *Review of guidelines and manuals for value chain analysis for agricultural and forest products.* ICRAF Occasional Paper 17. Nairobi: World Agroforestry Centre (ICRAF).

Poulton C., J. Kydd, S. Wiggins and A. Dorward (2006) "State intervention for food price stabilisation in Africa: can it work?" *Food Policy* 31(4): 342-356.

Rakotoarisoa, M., M. Iafrata, and M. Paschali. 2011. *Why has Africa become a net food importer? Explaining Africa's agricultural and food trade deficit*. Rome: Food and Agriculture Organization of the United Nations.

Rashid, S., and N. Minot. 2010. "Are staple food markets in Africa efficient? Spatial Price Analyses and Beyond." Paper presented at the Comesa policy seminar "Food price variability: Causes, consequences, and policy options", Maputo, Mozambique, January 25–26.

Rashid, S., and A. Negassa. 2011. *Policies and Performance of Ethiopian Cereal Markets*. ESSP II Working Paper 21. Addis Ababa, Ethiopia: International Food Policy Research Institute / Ethiopia Strategy Support Program II.

Reardon, T., K. Chen, B. Minten, and L. Adriano. 2012. *The Quiet Revolution in Staple Food Value Chains. Enter the Dragon, the Elephant, and the Tiger*. Mandaluyong City, Philippines: Asian Development Bank; International Food Policy Research Institute.

Schultz, T.W. 1953. The Economic Organisation of Agriculture. New York, McGraw Hill.

Teravaninthon, S., and G. Raballand. 2009. *Transport prices and costs in Africa: A review of the international corridors.* Washington, DC: World Bank.

Tomek, W.G., and K.L. Robinson. 1972. *Agricultural Product Prices.* Ithaca, NY: Cornell University Press.

Trienekens, J.H. 2011. "Agricultural value chains in developing countries: A framework for analysis." *International Food and Agribusiness Management Review* 14 (2): 51–82.

United Nations (UN) Population Division. 2010. *World Urbanization Prospects: The 2009 Revision*. New York: UN Population Division.

Webber, M., and P. Labaste. 2009. *Building competitiveness in Africa's agriculture: A guide to value chain concepts and applications*. Washington, DC: World Bank.

Williams, J.C., and B.D. Wright. 2005. Storage and Commodity Markets. Cambridge: Cambridge University Press. 520p.

World Bank. 2008. *World Development Report 2008: Agriculture for Development*. Washington, DC: World Bank.

———. 2009. *Eastern Africa: A study of the regional maize market and marketing costs.* Report number 49831-ET. Washington, DC: World Bank.

———. 2012. *Agribusiness Indicators: Ethiopia.* Report number 68237-ET. Washington, DC: World Bank.