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The Structure of Indigenous Food Crop Markets in sub-Saharan Africa: The Rice Market in Uganda

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ABSTRACT *Using data obtained from a series of nation-wide market surveys in Uganda, this article attempts to document and assess the domestic rice market at all stages in the post-harvest marketing chain from the farm gate to metropolitan area retail outlets. The criteria used are quantities marketed, prices, marketing margins, marketing costs and net returns to traders. The results show that the regional rice markets are integrated into the national market and that on average little surplus is left for rice traders at all market stages if marketing costs are accounted for. The spontaneously developed indigenous crop market works reasonably well.*

1. Introduction

There is no dispute about the importance of the food crop market in the development of agriculture. There has been, however, a deep division between two camps about what type of market it should be and who should handle market activities. One camp affirms that the indigenous food crop market works well and the other insists that it is inefficient and exploitative. A developing region where the two camps have been contending fiercely is sub-Saharan Africa (SSA). Here, following independence, most countries extended the state-controlled food crop market systems which they had inherited from their colonial predecessors, and under the guidance of international donor/lending agencies during the 1980s and 1990s were forced to liberalise these systems (Jayne & Jones, 1997; World Bank, 1994).

The literature on food crop markets in SSA until the 1970s was mostly concerned with the actual states of the indigenous crop markets in the pre-colonial phase (Gray & Birmingham, 1970; Hopkins, 1973) and in the pre-independence and early post- independence phases (Bauer, 1954; Bohannan & Dalton, 1962; Good, 1970; Hawkins, 1965; Hill, 1963; Jones, 1972; Martin, 1963; Meillassoux, 1971; Southworth, Jones, & Pearson, 1979). Most of these studies showed that the indigenous crop markets were reasonably efficient and sufficiently competitive to prevent traders from reaping excess margins. The literature in the pre-liberalisation phase, which pointed out the inefficiency and unsustainability of the state-controlled market systems (Bates, 1981; FAO, 1989; Jones, 1984; World Bank, 1981), was followed in the 1990s and early 2000s by many studies which evaluated the results of market liberalisation (Akiyama, Baffes, Larson, & Varangis, 2001; Barrett, 1997; Chirwa, 1999; Jayne & Jones, 1997; Kherallah, Delgado, Gabre-Madhin, Minot, & Johnson, 2002; Seppälä, 1997; Staatz,

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Dioné, & Dembélé, 1989; World Bank, 1994). The results were mixed, partly because many fundamental elements of the reform programmes either remained unimplemented or were reversed within several years (Jayne, Govereh, Mwanaumo, Nyoro, & Chapoto, 2002). Such reversals in the food crop markets towards state interventions, which were particularly prevalent after the food crisis of 2007–2008 (Oyejide, Alaba, Abidemi, & Balakrishnan, 2012), encouraged a further proliferation of market studies. A few of these studies reported some signs of imperfection (Fafchamps & Hill, 2008; Osborne, 2005; Traub & Jayne, 2008). However, most of them showed that unlike the assertion by the pro-intervention camp, the liberalised crop markets were competitive and free-entry with declining traders' margins; were spatially integrated with the degree of integration increasing in recent years; and demonstrated price volatility which was less than in the markets with government interventions (Abdulai, 2000; Chamberlin & Jayne, 2013; Chapoto & Jayne, 2009; Fafchamps, Gabre-Madhin, & Minten, 2005; Jayne, Zulu, & Nijhoff, 2006; Kijima, Otsuka, & Futakuchi, 2012; Minot, 2014; Myers, 2013; Rashid & Minot, 2010; Rashid, 2004; Sitko & Jayne, 2014; Tschirley & Jayne, 2010; Yamano, Arai, & Place, 2011).

In spite of economists' efforts to show evidence that the indigenous crop markets in SSA work well, the view of the market held by the pro-intervention camp, namely that it is chaotic, unorganised, inefficient, exploitative and fails to serve farmers in remote areas, has persisted among politicians, government officials, farmers and the general public. In 1978, an assistant director of a newly established government special marketing unit in Ghana was quoted in a newspaper as saying '[the unit] was determined to eliminate middlemen whose sole aim was to cheat farmers' (Southworth et al., 1979, pp. 157–158). Similarly in a newspaper in 2010, a district commissioner in Zambia was quoted as saying '[farmers] are being exploited by the briefcase dealers who are buying their produce at very low prices' (Sitko & Jayne, 2014, p. 56). The same view can be found in many reports by consultants who work closely with related government agencies (Agritrade, 2012; Chemonics International, 2010; Wilfred, 2006).[1]

One reason why such a stereotypical view about the crop markets persists could be that the evidence, which shows that the indigenous crop markets function well, is still insufficient. The literature is almost unanimous in its view that the markets are competitive in the sense that there are numerous sellers and buyers at all stages in the post-harvest marketing chain, thereby ensuring good performance in the formation of market prices. However, few studies directly show that the markets are competitive in such a way that they do not leave excessive margins to traders who operate in the post-harvest marketing chains. Some exceptional studies attempted the cost accounting of traders' marketing operations (Fafchamps et al., 2005; Jones, 1972; Timmer, Falcon, & Pearson, 1983), but the accounting was by no means complete, leaving doubt about whether a substantial surplus was left for traders.[2] Another weakness in studies on post-harvest marketing chain is that most of them examined a localised market at certain stages in the chain and failed to give a complete perspective of the crop markets from farm gate to consumers in urban centres.[3]

This article is an attempt to fill some of these gaps by documenting the national market for domestic rice in Uganda, using data obtained from a series of market surveys conducted across the country, with special reference to the structure and operation of the entire marketing chain from farm gates to metropolitan retail outlets. The rice market in Uganda is particularly suited to an examination of the performance of the indigenous crop market. As in many other SSA countries, rice is not a traditional staple crop in Uganda; but since the early 2000s, when NERICA (New Rice for Africa, a series of new rice varieties developed by AfricaRice) was introduced (Kijima, Sserunkuuma, & Otsuka, 2006), rice production has been increasing rapidly (Kikuchi, Kijima, Haneishi, & Tsuboi, 2014). Although the crop markets in Uganda experienced government interventions between 1968 and 1993, the degree of these was relatively light (Bibangambah, 1996; Chapoto & Jayne, 2009). In particular, the domestic rice market has never undergone government intervention, except for import controls by means of tariffs levied at the border. It provides, therefore, a rare case of a spontaneously developed indigenous crop market.

In the following section, we explain how data were collected. The third section gives a quantitative overview of the national rice market and the rice marketing chain from farm gates to urban retail outlets, and the fourth section introduces the rice market traders. The fifth section presents the prices by brand at all stages in the rice marketing chain, and tests for price parity across the regional markets.

In the sixth section, net returns to rice traders are estimated by accounting for marketing costs incurred at each stage of the rice marketing chain. The final section summarises the findings and discusses their implications.

2. Data Collection

To obtain an overall perspective of the post-harvest rice marketing chain in Uganda, we conducted a series of nationwide rice market surveys from March to September 2012. These consisted of (1) a trader survey, (2) a small grocery store survey, (3) a supermarket survey, and (4) a rice mill survey. In the trader survey, we interviewed traders who were engaged in buying and selling in the rice marketing chain. Traders included brokers, wholesalers and vendors operating in and around public markets in the Kampala district (Kampala hereafter) and in major cities and towns in the districts outside Kampala (Upcountry hereafter). The small grocery store survey covered small grocery stores which sold rice outside the public markets in Kampala. Supermarkets in Kampala and in major Upcountry cities and towns were visited in the supermarket survey. In the rice mill survey, we interviewed the owners or managers of rice mills operating in rice-producing Upcountry areas. Unless otherwise noted, all data used in this article were obtained from these surveys.

The samples for these surveys were obtained in two stages. At the first stage of the trader survey, we selected a sample of markets in Kampala and a sample of districts in Upcountry. At the second stage, we selected rice traders for interview from the selected markets for the former and from the major market in the capital town of the selected districts for the latter. The selection of sample markets in Kampala and of sample districts in Upcountry was designed to represent major and typical markets. In each sample market in Kampala and in the capital town of each sample district, we counted the number of rice traders, and then selected randomly at least 10 per cent of them for interview. For the small grocery store survey in Kampala, we divided the entire Kampala district into 70 isometric rectangular blocks and counted the number of small grocery stores which sold rice in 14 randomly selected sample blocks. We then randomly selected for interview a sample of the small grocery stores. We used the same sampling method for the supermarket survey in Kampala. For the Upcountry sample, we first counted the number of supermarkets in each capital and major market towns in the sample districts, and then randomly selected supermarkets for interview. In the rice mill survey, we selected a sample of districts from all the rice-producing regions in the country, and randomly chose a sample of rice mills within these districts for interview.

The numbers of the samples in the four market surveys and their estimated population totals are shown in Table 1 for Kampala by division and for Upcountry by region. The sampling ratios are not high and vary considerably across the Kampala divisions and the Upcountry regions. The major data obtained from rice traders and small grocery stores were the quantity of rice bought and sold, the places of procurement and destination, the buying and selling prices of rice by variety/brand, and the costs involved in marketing operations. In the supermarket survey, the quantity and price of rice sold were obtained by brand. The data obtained from rice mills were the quantity of rice milled by variety/brand, its sources and destinations, and the price of rice by variety/brand. Simple one-page questionnaires were used in these surveys, but because of time and other constraints during the interviews, some respondents did not answer all of the questions, thereby resulting in missing data. With regard to the quantity of rice produced and marketed, the time reference was one year from October 2011 to September 2012. With regard to the rice price, which is subject to seasonal fluctuations, the data used in this study were confined to those obtained during March–April 2012. The two rice-growing seasons in the years 2011–2012 were both considered normal seasons (Kikuchi et al., 2014).

3. Quantitative Structure

Table 2 shows the quantities of rice produced and consumed in Uganda in 2011–2012. We identify two types of rice producer: smallholder rice farmers and rice estates/companies. The quantity of

Table 1. Number of samples in the market surveys and their population totals, 2012[a]

	Kampala							
	Samples surveyed				Total (population)			
Kampala division	Public market	Rice trader	Small grocery store	Supermarket	Public market[b]	Rice trader[c]	Small grocery store[d]	Supermarket[e]
Central	5	25	0	4	6	195	0	9
Kawempe	3	17	6	6	21	187	898	71
Nakawa	2	8	4	7	11	180	95	37
Makindye	4	12	6	5	9	47	388	43
Rubaga	4	13	7	7	20	368	374	55
Total	18	75	23	29	67	977	1755	215

	Upcountry							
	Samples surveyed				Total (population)			
Upcountry region	Districts[f]	Rice trader	Rice mill	Supermarket	Districts[f]	Rice trader[g]	Rice mill[h]	Supermarket[i]
North	5	21	15	7	21	704	105	83
East	14	44	32	11	24	1011	359	165
Central	9	28	15	7	14	500	64	80
West	7	31	8	8	19	1002	117	107
Total	35	124	70	33	78	3216	645	433

Notes: [a] For sampling methods, see the text. Public market refers to marketplaces where many vendors and shops gather to sell various commodities; rice trader refers to traders who are engaged in buying and selling rice in and around public markets; small grocery store refers to traditional small retail stores which are located outside public markets and sell rice loose and not in packages; and supermarket refers to self-service stores where rice is sold not loose but in packages. For more details, see Kikuchi et al. (2013).
[b]Data are from the Kampala Capital City Authority (KCCA).
[c]Estimated by multiplying the average share of rice traders obtained from the trader survey by the total number of traders in all the public markets in each division. Data on the total number of traders are from KCCA.
[d]Estimated by multiplying the average numbers of small grocery stores for each sample block drawn from 70 Kampala blocks by the number of blocks in each division.
[e]Supermarkets are first classified into three classes according to the size of their sales-floors: large; small; and mini. The total number of each class is estimated by multiplying the average numbers of supermarkets for each class in each of the 14 sample blocks drawn from 70 Kampala blocks by the number of blocks in each division, and aggregated over the three classes. For more details, see Kikuchi et al. (2015).
[f]Districts prior to the administrative reorganisation in 2010.
[g]Estimated for each region by multiplying the average number of rice traders per capita in the sample districts by the population of the respective region. The data on population as of 1 January 2012 are from the Uganda Bureau of Statistics.
[h]Estimated from our rice mill survey. For more details, see Tokida et al. (2014).
[i]Estimated for each region in two steps: first the number of supermarkets in each non-sample district is estimated by using a simple regression equation which was estimated, using the data for the sample districts, to explain the number of supermarkets per capita by the population density; and second, the numbers are aggregated for the regions.

rice produced by smallholders was estimated by region as the total quantity of rice milled by rice millers in each region, and that produced by estates/companies with their own rice mills was estimated as the quantity of rice sold for final consumption. Since we are interested in the marketing channels through which domestically produced rice goes from farm gates to consumers, the quantity of rice consumed by rice farmers at home was deducted from total rice production. The quantity of rice consumed was estimated by division in Kampala and by region in Upcountry as the total quantity of rice sold for final consumption.[4] With regard to production and

Table 2. Production and consumption of rice in Uganda by brand and by region of production/consumption, 2011–2012[a]

	Upcountry							
	North	East	Central	West	Kampala[g]	Supermarket[h]	Total	
Production:[b]				1000 t				(%)
Supa	7	23	0	0			31	(26)
Kaiso[c]	3	33	1	0			38	(32)
Upland[d]	12	6	5	20			43	(37)
Estates[e]		5					5	(4)
Total	22	67	6	21			116	(100)
(Exported)	2	3		1			5	
Consumption[f]								
Supa	9	13	4	7	16	0	50	(43)
Kaiso[c]	4	15	3		10		33	(28)
Upland[d]	6	2	1	11	10		29	(25)
Estates[e]		0	0	1	0	4	5	(4)
Total	19	31	9	18	36	4	116	(100)
Imported	4	3	12	8	20	4	52	

Notes: [a]In milled rice equivalent. A blank cell means no quantity and 0 stands for a quantity less than 500 t. The totals may not tally with the corresponding summation because of rounding.
[b]Domestic rice which is produced and marketed by smallholders and rice estates. The quantity of rice produced by smallholders (Supa, Kaiso and Upland) is estimated as the total quantity of rice milled by rice millers, estimated by multiplying the average amount of paddy rice milled per sample rice miller by the number of rice millers. The quantity of rice consumed by smallholders at home is deducted from total rice production, assuming a home consumption rate of 24 per cent based on UBOS (2010) and Haneishi et al. (2013). Paddy rice is converted to milled rice by the rate of 0.65, a figure obtained from our rice mill survey. The quantity of rice produced by estates/companies is estimated from our trader survey as the quantity of rice sold for final consumption.
[c]Includes a small amount of exceptional cases for other lowland varieties, such as Benenego and Buyu in East.
[d]Mostly NERICA varieties, but includes a small amount of other upland varieties such as Sindano in North.
[e]Rice produced and marketed by large rice estates/companies, estimated from our rice trader survey.
[f]Rice sold for consumption by rice traders, small grocery stores and supermarkets, estimated from our market surveys by multiplying the average quantity sold at each type of retail outlet by the number of outlets of that type. More details about rice sold for consumption are available in Kikuchi et al. (2015).
[g]Kampala, with no rice production, is a 'rice consuming-region'.
[h]Rice sold by supermarkets in Kampala as well as in Upcountry is totalled under the heading of 'supermarket' regardless of region.

consumption, the estimations were made by dividing Upcountry into eight regions and then aggregating these to four as shown in Table 2.

A salient feature of the market for rice produced by smallholders is that the number of brands, or variety groups, recognised in the market is surprisingly small. Virtually, there are only three brands: Supa (also called Super); Kaiso; and Upland. Supa is a lowland variety, popular for its slightly aromatic property; Kaiso is a group of lowland varieties; and Upland is mostly NERICA varieties. Rice farmers plant many different varieties, but when rice is sold to consumers, it appears under one of the three names given here. In contrast, the rice produced by rice estates/companies is sold under many brands. In Table 2, all the rice produced by estates/companies is shown under the heading of 'Estates' regardless of brand.

The quantity of rice produced and marketed in 2011–2012 was estimated at 121,000 t, of which 5,000 t (4%) were exported. Of the local rice in the market, 96 per cent was produced by smallholders. The corresponding quantity consumed was 169,000 t, of which 52,000 t (31%) were imported from foreign countries. Of the total rice bought for consumption, 95 per cent was purchased through the indigenous rice markets, leaving only 5 per cent for supermarkets.[5] Kampala was the largest consumption region, with one-third of the total quantity of rice consumed in the country. However, with regard to local rice, East consumed nearly as much as Kampala, followed by North and West. Of the four Upcountry

regions, North, East and West were net rice exporting regions and Central was a net rice importing region. Of the three brands of local rice, Supa and Kaiso were mainly produced in East, and Upland in West and North. The production data obtained from rice mills show that the largest quantity produced was Upland, followed by Kaiso and Supa in that order, while the consumption data obtained from rice retailers show the direct opposite of this order. This suggests that many non-Supa varieties were disguised as, or mixed up with, Supa in the marketing chain after processing at the rice mill.[6]

4. Marketing Chain and Rice Traders

This section examines the post-harvest marketing chain for rice from smallholders, which accounts for 96 per cent of the rice produced and marketed in Uganda. The marketing chain through which rice goes from farm gates to final consumers is depicted schematically in Figure 1.

Because there is no tradition of rice milling by hand pounding in Uganda, virtually all of rice produced by smallholders is brought to rice mills after harvesting and drying on the farms. From the rice mills, apart from the rice brought back home for farmers' own consumption, rice goes to public markets in its own Upcountry regions, to public markets in Kampala, and to foreign countries. Though not made explicit in Figure 1, within Upcountry, rice goes from a region to other regions, and some of the rice brought to Kampala then goes to Upcountry regions. Rice reaches consumers through public markets in Upcountry and Kampala.

At the beginning of the rice marketing chain, rice mills, located either in major district towns or in villages in rice-producing areas, play a pivotal role as nodal points where many actors involved in the chain gather together. Farmers who produce rice, village collectors (assemblers) who buy rice from farmers and town brokers/wholesalers who send their agents to rice-producing villages to buy rice all bring their paddy rice to the rice mills. Many rice millers also engage in rice brokerage and purchase paddy rice from farmers. Town rice brokers, also called suppliers or middlemen, operate around rice mills. They sell milled rice, bought from farmers or village collectors, to rice vendors (retailers) in local public markets and to wholesalers/suppliers who come to rice mills from Kampala and other towns in Upcountry. Rice bought by Kampala wholesalers/suppliers goes to Kampala wholesale markets where market vendors and small grocery stores buy it.

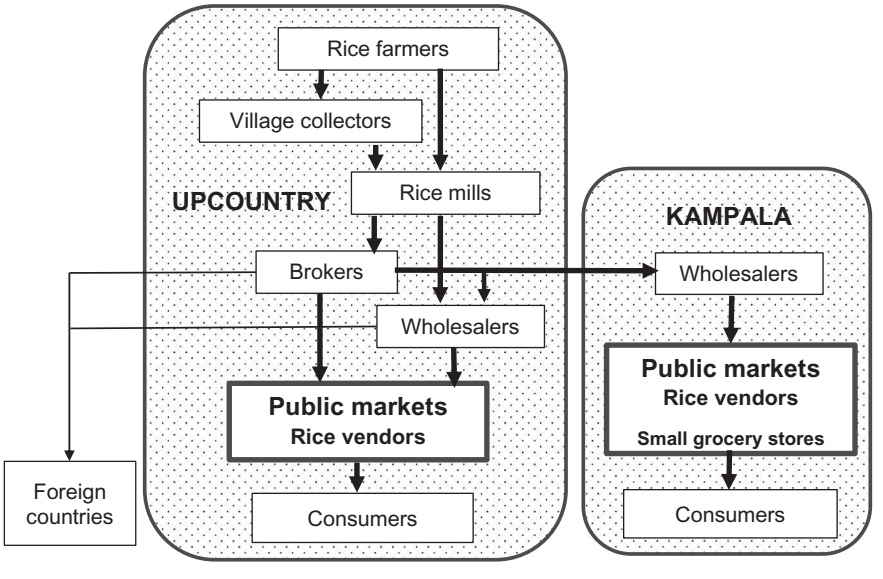

Figure 1. Flows of domestic rice produced by smallholders from farm gates to consumers, Uganda, 2012.
Note: A part of the rice sent to Kampala goes from city to other region in Upcountry (Kikuchi et al., 2014), but is not shown here because the quality is very small.

Town wholesalers also engage in rice brokerage. The difference between brokers and wholesalers is that brokers do not usually have a shop; instead they have a storage space for rice alone or for rice, other grains and flours. Wholesalers have shops as well as storage and usually handle many commodities apart from local rice including imported rice, other food items such as maize and cassava flour, and many necessaries for daily living.

The main function of town brokers is to buy a few sacks of paddy rice from each farmer at farm gates or of milled rice at rice mills, and accumulate sacks of milled rice to sell in bulk to buyers from Kampala. When they come, the Kampala buyers visit a few rice mills in a town or a few towns in rice-producing areas, meet town rice brokers at or around rice mills, and buy rice until they reach their target quantity – for example, 100 sacks (a 10-ton truck load). Then they hire local transporters to carry the rice sacks to Kampala. With few exceptions, all transactions are made in cash among farmers, town brokers, Kampala buyers and transporters.[7]

Kampala buyers are wholesalers, brokers and suppliers who operate in or around major wholesale markets in Kampala. Kampala wholesalers have shops and usually handle many commodities, while Kampala brokers/suppliers more or less specialise in rice brokerage and wholesaling, usually without shops. Market rice vendors in Kampala public markets and small grocery stores acquire their rice from wholesalers at Kampala wholesale markets, by phoning the delivery service of Kampala suppliers or from the mobile suppliers who visit many retail-oriented public markets in Kampala.

In the same way as crop traders in other SSA countries (Fafchamps et al., 2005), rice traders are not integrated vertically along the rice marketing chain from farm gates to Kampala retailers. Upcountry brokers/wholesalers operate in and around their towns and Kampala wholesalers operate in Kampala. An exception to this is the initial stage between farm gate and mill gate, whereby some Upcountry brokers and rice millers go to rice farmers to buy rice, bypassing the village collectors. Although the scale of operation varies widely among brokers/wholesalers, there are no extra-large traders who dominate the market. There are some large rice estates/companies, but their marketing chain is independent to that of rice produced by smallholders.

In the rice trader survey, we interviewed brokers, suppliers, wholesalers and vendors. The function of the first three types of trader is brokerage/wholesaling, while that of vendors is selling rice to consumers. However, the distinction between brokers/wholesalers and retailers is often vague. Some wholesalers have consumers as customers, while it is also fairly common among market vendors to sell rice wholesale to customers who make bulk purchases. Our trader survey showed that rice traders whose monthly rice sale was below 10 t rarely sold rice wholesale. In this study, therefore, rice traders whose amount of rice sale is less than 10 t/month are regarded as rice retailers and the rest of them are regarded as rice brokers/wholesalers.

The average rice sale per month per retailer is 1.6 t in Upcountry markets and 3 t in Kampala markets, and the corresponding figure for brokers/wholesalers was 45 t and 49 t respectively (Table 3). The procurement frequency, or the interval between the time when a trader procures rice and when he/she procures the next batch after selling all the prior stock, varies widely: some traders procure rice every five days and some others every four months. On average, however, the procurement interval is 1.1 months for retailers and brokers/ wholesalers in Kampala as well as in Upcountry.

Nearly half of retailers and more than one-fifth of brokers/wholesalers are female (Table 3). On average, rice retailers and brokers/wholesalers began their operations 7–10 years ago; that is, in 2002–2005, the years when the government began promoting NERICA cultivation. Many traders have also joined the rice trading business quite recently: the mode of the 'years-of-experience' distribution with five-year interval is 'less than five years' for both Upcountry and Kampala. This suggests that the entry barrier to the rice trading business is low. All the rice traders in the sample, except an old female vendor in West, had a mobile phone, and quite a few of them had more than one.

Table 3. Number of sample rice traders, their monthly rice sales and procurement intervals by size class, and their profiles, Upcountry and Kampala, 2012[a]

	Upcountry				Kampala			
Monthly rice sales: size class	No.	Mean sales t/month	% local rice[b] %	Procurement interval[c] month	No.	Mean sales t/month	% local rice[b] %	Procurement interval[c] month
Below 1 t	45	0.4	76	1.3		0.5	60	1.3
1–10 t	48	2.8	74	1.0	31	4.2	59	0.9
Retailer: mean		1.6	74	1.1		3.0	59	1.1
10–20 t	10	13.3	54	1.3	10	12.0	82	1.2
20–40 t	8	28.7	72	1.1	7	32.2	54	1.1
40–70 t	6	50.0	84	0.8	7	51.0	17	1.1
70 t -	7	103.6	67	1.0	5	145.8	67	1.1
Broker/wholesaler: mean		44.8	70	1.1		49.4	54	1.1

	Upcountry		Kampala	
	Retailer	Broker/ wholesaler	Retailer	Broker/ wholesaler
% of female traders	47	21	44	23
Years of operation	7	9	10	10
% with mobile phone	99	100	100	100

Notes: [a]From our rice trader survey.
[b]The percentage share of local rice in total sales.
[c]The interval between the time when a trader procures rice and when he/she procures the next batch after selling all prior stock.

5. Price Structure

Table 4 presents the mean prices of domestic rice for the three brands at each market stage along the post-harvest marketing chain from farm gate to Kampala retailer. Five stages are identified. The first is the farm gate at which farmers sell paddy rice to village collectors or agents of brokers/rice mills. The second is the Upcountry rice mill gate at which farmers or village collectors sell milled rice to town brokers/wholesalers. The third is the Upcountry wholesale market at which town brokers sell rice to Kampala wholesalers or town retailers (rice vendors). The fourth stage is the Kampala wholesale market at which Kampala wholesalers sell rice to Kampala retailers (rice vendors and small grocery stores). The Upcountry retail market is at the same stage as the Kampala wholesale market. The last stage is the Kampala retail market at which retailers sell rice to consumers. In the whole marketing chain, rice changes ownership five times, including the village collector.

Three points must be mentioned regarding Table 4. First, among the three brands, Supa commands a higher price than Kaiso and Upland at each stage, while the difference in price between the latter two is quite small. This observation suggests that in the domestic rice markets Supa is the clearly identified superior brand compared with the other two. Second, the difference between the selling and buying prices at the third and fourth stages is quite small. In a localised market with no transport costs, these prices are supposed to be identical. Third, the price variations at each market stage are not large. In the wholesale and retail markets in Kampala, the variations are small, with all of them less than 10 per cent in terms of the coefficient of variation (CV). Even in Upcountry, for which the price data were collected from many markets scattered over the country, the CVs are 12 per cent or less, except for the farm gate prices of Kaiso and Upland. Taken together, the last two observations suggest that the Upcountry and Kampala rice markets are well integrated into the national rice market where the law of one price prevails.

Table 4. Mean prices of domestic rice in the markets along the post-harvest marketing chain from farm gate in Upcountry to retailers in Kampala, and their variation by brand, March-April 2012[a]

		Average price			Price variation (CV)[c]		
	Market stage	Supa	Kaiso	Upland	Supa	Kaiso	Upland
		….. USh/kg …..			….. % …..		
Upcountry markets:							
Farm gate[b]	I	2583	2220	2166	11	16	22
Mill-gate (broker buying)	II	2919	2460	2455	10	10	11
Broker selling	III	3166	2627	2661	10	10	11
Kampala wholesaler buying	III	3168	2567	2700	7	8	5
Retailer buying	III	3142	2761	2750	12	6	8
Retailer selling	IV’	3471	2957	3068	9	5	7
Kampala markets:							
Wholesaler selling	IV	3337	2832	2885	6	8	4
Retailer buying	IV	3324	2841	2858	7	8	6
Retailer selling	V	3651	3121	3060	7	7	6

Notes: [a]From our rice trader and rice mill surveys.
[b]The buying prices of Upcountry brokers/rice mill agents at the farm-gate, converted from paddy prices assuming an average milling rate of 0.65.
[c]CV stands for coefficient of variation.

Table 5 presents the results of an attempt to describe statistically the price structure of the market by means of regression analysis. The price of domestic rice was regressed on dummy variables to represent the market stages and agents, and to control four sources of price variation: brands; dates of transaction; Upcountry regions; and Kampala divisions. Regression 1, using only the market-stage dummy group, gives the coefficient of determination (R^2) of 0.40. With all the dummy groups, R^2 increases to 0.70, leaving 30 per cent of the total price variation in the post-harvest marketing chain unexplained. The partial R^2s for Regression 2 by dummy group, obtained by adding the partial R^2 of each dummy variable for each dummy group, indicate that the largest source of price variation is the price difference due to the difference in market stage, followed by the price difference stemming from the difference in brand. The other three dummy groups explain very small parts of the price variation. In particular, the price variations due to two location dummy groups are nearly negligible.

With regard to the brand dummy group, Regression 2 shows that the price of Supa is significantly higher than that of Upland, while Kaiso and Upland are not distinguishable at all in terms of price. These results imply that, as far as price is concerned, there are only two rice ‘brands’ in the domestic rice market in Uganda: Supa and non-Supa. Second, three date dummy variables are all positive and significant, indicating that the rice price increased from early March to late April. Third, of the four Upcountry regions, the price in North is significantly lower than the prices in East and West, while there is no significant price difference among East, Central and West. This result is consistent with the fact that the major rice-producing areas in North are located farther away from Kampala than those in East and West. A longer distance from the market centre makes transport costs higher, resulting in a lower price in the peripheral markets. Fourth, among the five divisions in Kampala, the price is significantly lower in Kawempe than in all the other divisions, among which no significant price difference is found. The lower price in Kawempe can be explained by the fact that the major wholesale markets for domestic rice are concentrated in this division.

After controlling four sources of price variation, the estimated regression coefficients of the market-stage dummy variables in Regression 2 show that the price increases significantly from one stage to the next, with a margin of 200–300 Ugandan shillings (USh) (approximately US$ 1 = USh 2500 as of March–April 2012) at each stage. The null hypothesis of the parity of the price margins across brands, separately tested, is not rejected. Within each stage, the selling and buying prices are statistically indistinguishable. The total price spread between farm gate and

Table 5. Results of the regression analysis, regressing the rice price (USh/kg) on dummy variables for market levels, rice brands, dates, Upcountry regions, and Kampala divisions, March-April 2012[a]

		1		2			
	Market stage	Coeff.	SE	Coeff.	SE		Notes
Intercept	I	2308	58	1969	64		
Market-stage dummy (base = farm gate):							b
Upcountry broker: buying	II	292	70	314	50		
Upcountry broker: selling	III	516	69	519	49		
Kampala wholesaler: buying	III	592	79	496	59		c
Upcountry retailer: buying	III	640	74	531	53		
Upcountry retailer: selling	IV'	942	73	825	53		d
Kampala wholesaler: selling	IV	772	79	836	72		e
Kampala retailer: buying	IV	761	72	760	71		
Kampala retailer: selling	V	1055	70	1049	68		
Brand dummy (base = Upland):							f
Kaiso				−16	32	ns	
Supa				482	28		
Date dummy (base = early March):							
Late March				100	42		
Early April				225	42		
Late April				257	50		
Upcountry regional dummy (base = North):							
East				87	31		
Central				−3	97	ns	g
West				149	52		
Kampala division dummy (base = Rubaga):							
Kawempe				−124	53		
Central				3	56	ns	h
Nakawa				106	70	ns	
Makindye				−35	70	ns	
R^2		0.397		0.704			
Partial R^2: market stage-agent dummy				0.376			
Brand dummy				0.306			
Date dummy				0.014			
Upcountry region dummy				0.004			
Kampala division dummy				0.004			
Number of observations		596		596			

Notes: [a]Regression by ordinary least squares. SE stands for standard error. The estimated regression coefficients are statistically significant at the 5 per cent level or higher unless marked 'ns'.
[b]The means of prices are all significantly different between adjacent stages (tested by altering the dummy base for all possible cases).
[c]No significant price difference among the three means at the same stage (tested by altering the dummy base for all possible cases).
[d]Significantly different from the price at Stage V.
[e]No significant price difference between the two means at the same stage (tested by altering the dummy base for all possible cases).
[f]Cross-dummies between brand and market stage were all insignificant; hence not included in Regression 2.
[g]The price in North is lower than the prices in East and West, and there is no significant inter-regional price difference for the rest of the regions (tested by altering the dummy base for all possible cases).
[h]The price in Kawempe is lower than the prices in all other divisions, and there is no significant inter-division price difference for the rest of the divisions.

Kampala retailer given by Regression 2 is USh1049/kg. The ratio of the farm gate price to the Kampala retail price, which varies slightly depending on the brand, date, and region, ranges from 65 to 73 per cent, with an average of 69 per cent. The ratio of this level is higher than, or

comparable with, the level reported in earlier studies. PMA Secretariat (2009) reported that the ratio was as low as 55 per cent in the conflict-stricken northern regions in Uganda. It is compared with 54 per cent in Nigeria (Welsch, 1966), 71 per cent in Ghana (Timmer et al., 1983), 65 per cent in the Philippines and 80 per cent in Thailand (Dawe, Moya, Casiwan, & Cabling, 2008). For maize, which is traded in a similar style as rice, this ratio was 54 per cent in Nigeria and 62 per cent in Sierra Leone (Jones, 1972), 56 per cent in Ghana (World Bank, 2007) and 71 per cent in Uganda and 85 per cent in Kenya (Yamano et al., 2011). In this context, the efficiency of the Ugandan rice market measured by this ratio can be said to be reasonably high.

Altogether, Regression 2 suggests that, as far as the formation of price is concerned, the rice markets at each stage in Upcountry as well as in Kampala are functioning reasonably well. They are integrated, horizontally as well as vertically, into the national rice market, with the possible exception of the first market stage. Such results are expected. With no entry barrier to the industry, a large number of Upcountry and Kampala traders compete with each other in buying and selling rice. Further, the use of mobile phones has made it easier among traders to exchange information on the markets, the price information in particular. It is worth mentioning that the rice market is not exceptional among the crop markets in Uganda. Many studies in the past, old studies in the pre-independence era (Martin, 1963; Mukwaya, 1962) and recent studies (Rashid, 2004; Yamano et al., 2011) alike, found that the indigenous markets for various food crops in Uganda were competitive and work well in this respect. This is also the case in other SSA counties. Many studies which examined the price formation and integration of crop markets in SSA countries using time series methods found that the markets function relatively well in terms of price formation (Rashid & Minot, 2010).

6. Market Margins, Marketing Costs and Traders' Return

If the Ugandan rice market described thus far is truly competitive, the profits accruing to rice traders should be null at the long-run equilibrium. We now try to account for the costs of all the inputs used in the post-harvest marketing chain to produce marketing services so as to examine how well the rice market works in this respect.

Table 6 shows rice prices, price margins, marketing costs and rice traders' returns in the rice marketing chain. The rice price at each stage is the average of the three brands estimated for early March and for East and West[8] by using Regression 2 in Table 5. The total margin, or the price spread between farm gate and retail outlet in Kampala, of USh1049/kg accounts for 31 per cent of the Kampala retail price. The five marketing stages make four marketing layers, each of which forms a price margin, taking 6–9 per cent of the Kampala retail price. The marketing costs incurred at each layer in the post-harvest rice marketing chain are enumerated and the traders' net return at each layer is calculated by subtracting from the price margin of a layer all the costs incurred in that layer.

6.1. Marketing Costs

The definitions, assumptions, and explanations of the marketing costs are given in the remark column and footnotes of Table 6. Some cost items need additional explanations.

First, transport cost has been said to be the most important cost item because it has a high share of total marketing costs in SSA, due mainly to the region's poor road infrastructure (Martin, 1963; Rashid & Minot, 2010; Teravaninthorn & Raballand, 2009; Whetham, 1972; World Bank, 2007). As in other parts of the world, rice in Uganda is transported and stored in sacks. Each sack weighs approximately 100 kg and is transported by trucks for a long distance,[9] by motorcycles (*bodaboda*) for a short distance, and by bicycles for an even shorter distance. A man can carry a sack on his shoulder, but only for a very short distance. With the exception of those few large wholesalers who own trucks, transport is hired. Regardless of the distance to be transported and of

Table 6. Average price of domestic rice at the five stages of the marketing chain, post-harvest marketing costs, and traders' returns, East and West regions, early March 2012

	Price/Cost[a]			
	USh/kg	%[b]	%[c]	Remarks
1. Farm gate price	2281	69		In milled rice, as of early March in East/West.
Transport	41	1	4	By truck. Assumed distance: 70 km.
Loading/offloading	16	0	2	Wage for hired workers in Upcountry.
Sack	10	0	1	
Village collector	20	1	2	Commission agents to collect paddy rice from villages.
Rice milling	150	5	14	Average rice milling fee.
Traders' time (labour)	25	1	2	Costs of traders' work time spent for rice trading.[d]
Capital interest	56	2	5	i = 27%/year (2.2% for 1.1 month) for the acquisition price plus costs[e]
Traders' net return (residual)	−4	0	0	Traders could be farmers, town brokers or rice millers.
Total	314	9	30	
2. Mill gate price	2595	78		Upcountry brokers' buying price
Transport	22	1	2	By truck. Assume the distance: 10 km.
Loading/offloading	16	0	2	Wages for hired workers in Upcountry.
Shop/Storage	11	0	1	Average rental rates for brokers/wholesalers in Upcountry.
Tax/duties/charges	5	0	0	Taxes, duties, licence fees, parking charges, tip for law enforcers, etc.
Traders' time (labour)	19	1	2	Costs of traders' and their workers' work time.[f]
Capital interest	59	2	6	i = 27%/year (2.2% for 1.1 month) for the acquisition price plus costs.[e]
Brokers' net return (residual)	69	2	7	
Total	201	6	19	
3. Upcountry brokers' selling price	2796	84		Kampala wholesalers' buying price
Transport	64	2	6	By truck. Assumed distance: 300 km.
Loading/offloading	17	1	2	Wage for hired workers in Upcountry and Kampala.
Sack	10	0	1	
Stitching sack	2	0	0	
Weighing sack	3	0	0	
Shop/Storage	22	1	2	Average rental rates for wholesalers in Kampala.
Trip for procurement	4	0	0	Two-day trip for Upcountry to procure rice.[g]
Tax/duties/charges	8	0	1	Taxes, duties, licence fees, parking charges, tip for law enforcers, etc.
Traders' time (labour)	17	1	2	Costs of traders' and their workers' work time.[h]
Capital interest	65	2	6	i = 27%/year (2.2% for 1.1 month) for the acquisition price plus costs.[e]
Wholesaler's net return (residual)	70	2	7	
Total	283	8	27	
4. Kampala wholesalers' selling price	3079	92		Kampala retailers' buying price
Transport	23	1	2	By motorcycle. Assumed distance: 2 km.
Loading/offloading	18	1	2	Wages for hired workers in Kampala.
Cleaning	40	1	4	Cleaning rice by removing odd materials manually.

(*continued*)

Table 6. (*Continued*)

	Price/Cost[a]			
	USh/kg	%[b]	%[c]	Remarks
Stall/shop	29	1	3	Average rental rates for Kampala retailers.
Tax/duties/charges	6	0	1	Taxes, duties, licence fees, parking charges, tip for law enforcers, etc.
Traders' time (labour)	61	2	6	Costs of traders' and their workers' work time.[i]
Capital interest	72	2	7	i = 27%/year (2.2% for 1.1 month) for the acquisition price plus costs.[e]
Retailer's net return (residual)	1	0	0	
Total	250	8	24	
5. Kampala retailers' selling price	3329	100		
Total margin	1048	31	100	Between the farm gate and Kampala retail price.

Notes: [a]The rice prices at the five marketing stages are the weighted averages of the prices of Supa, Kaiso and Upland in East and West at the respective stages estimated by Regression 2 (Table 5) for early March. The weights used are the quantity shares of these brands and regions in the total domestic rice produced and marketed by smallholders (Table 2). For the third and fourth stages at which the sellers' and buyers' prices are available, their simple averages are taken.

[b]Percentage share relative to the consumer price in Kampala (the Kampala retailers' selling price).

[c]Percentage share relative to the total market margin.

[d]Assume a village-level trader handling 3 t/month of rice, working alone with an opportunity wage rate of USh .3 million/month, and trading rice for 25 per cent of his/her time.

[e]The interest rate for the gestation period of n is estimated as $n\, i_n \log(1+i_n) = (1/(12/n))\log 1.27$, where n = the gestation period. The gestation period of 1.1 months is taken from Table 3.

[f]Assume an Upcountry broker handling 45 t/month of rice (Table 3), working with a family worker and a hired helper with opportunity wage rates of USh1 million/month, USh0.5 million/month and USh0.2 million/month respectively, and with rice representing 50 per cent of total sales.

[g]Include fares for public bus services between Kampala and towns in rice producing districts 300 km away (approximately the distance to Mbale in East or Hoima in West) and lodging. The quantity procured is assumed to be 10 t.

[h]Assume a Kampala wholesaler handling 49 t/month of rice (Table 3), working with a family and a hired worker with opportunity wage rates of USh1 million/month, USh0.5 million/month and USh0.2 million/month respectively, and with rice representing 50 per cent of total sales.

[i]Assume a Kampala retailer handling 3 t/month of rice (Table 3), working with a hired helper with opportunity wage rates of USh0.5 million/month and USh0.05 million/month respectively, and with representing one-third of total sales.

the means of transportation, the cost of transport at a piece rate is negotiated on the spot between a consignor and a transporter, and the sacks are taken by the transporter to the consignor's destination without the consignor on board. There are cases, albeit exceptional, in which rice traders hire trucks (with drivers) for a time rate. Data on the cost of transporting rice sacks by trucks or motorcycles, obtained from the rice trader survey, are plotted in Figure 2. A clear negative log-linear relationship is found between the unit transport cost per kg of rice and the distance transported. The simple regression equation shown in the figure confirms that the rate of transport cost decreases significantly as the distance increases, with a distance elasticity of −0.75.[10] The inclusion of a dummy variable for motorcycle in the regression gave a positive significant coefficient for the dummy as shown in the note to Figure 2.[11] In Table 6, the transport cost is estimated by using this regression equation. The distance rice is transported at each layer is given in the table, based on the data from the trader and rice mill surveys.

Second, with regard to the cost of rice milling, the average fee obtained from the rice mill survey is taken as the unit milling cost (Tokida, Haneishi, Tsuboi, Asea, & Kikuchi, 2014). Third, rice traders

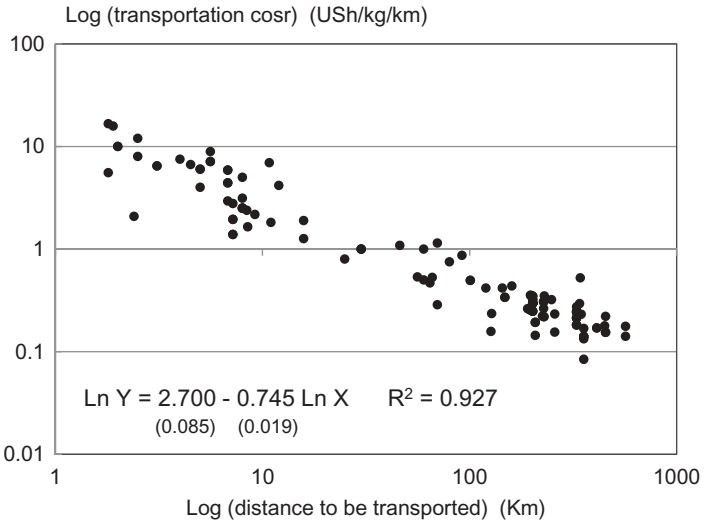

Figure 2. Transportation costs for rice (USh/kg/kg) and the distance to be transported (km)
Note: The regression equation with a dummy variable for motor-cycle (D) is estimated as follows:

$$\underset{(0.085)}{\text{Ln } Y = 2.379 - 0.687 \text{ LnX}} + \underset{(0.019)}{0.539 \text{ D}} \quad R^2 = 0.938$$

Figures in parentheses are standard errors.

have shops/selling stalls and storage facilities. Many Upcountry brokers and retailers retain storage spaces and sometimes use them as sales spaces.[12] Some wholesalers own their shop and storage facilities, but it is more common to rent the facilities. Rice brokers usually specialise in rice, but some of them handle a few other crops, and rice wholesalers and retailers usually sell many commodities other than rice. With such cases, the elements of shop and storage rentals which are provided for rice are given on a pro rata basis by using the percentage share of rice sales to total sales. Fourth, rice traders pay various taxes, duties, fees and charges, such as trading licence fees, market taxes, parking charges for loading/offloading, and tips for law enforcers. In case these payments are lump sums for sales operations as a whole, they are calculated on a pro rata basis.

Fifth, an annual interest rate of 27 per cent, which was the average interest rate paid by our sample of traders and rice millers who borrowed money, is used to impute capital interests,[13] although the number of observations is limited partly because borrowing money was not popular.[14] The gestation period for traders' investments is assumed to be the same as the rice procurement interval of 1.1 months (Table 3). Sixth, 'Trip for procurement' is the cost incurred when Kampala wholesalers go to rice-producing Upcountry areas to procure rice. These procurement trips usually take two days, using public transportation such as regular bus or mini-bus (taxi) services. The estimated cost includes the fares for these bus services and lodging, assuming that the trip is from Kampala to towns in rice-producing districts 300 km away, which is approximately the distance to Hoima (the principal upland rice distribution centre) in West or Mbale (the principal lowland rice distribution centre) in East. Seventh, with few exceptions, the quality of rice milling in Uganda makes it necessary to clean milled rice by removing stones, husks and other materials which are mixed with rice in the paddy-drying and milling processes. Rice retailers perform this cleaning by hiring women on a piece-rate payment per sack. Finally, the costs of traders' and their family/hired workers' time are imputed, assuming a typical rice trader at each market stage.

Table 6 reveals that the total transport cost, including loading and offloading costs, is USh217/kg, taking 21 per cent of the total price spread and 7 per cent of the Kampala retail price. The burden of transport cost is as heavy as that in other SSA countries.[15] The largest marketing cost item, however, is not transport but capital interests, which amounts to USh252, or 24 per cent of the whole price spread.[16]

6.2. Traders' Net Returns

If all the costs associated with the marketing activities at a marketing layer are wholly accounted for, traders' net return is the profit for the rice traders working at this layer, a profit which should be null in a competitive market with long-run equilibrium. Table 6 shows that estimated traders' net returns for village-level traders and Kampala retailers are negligibly small. Such results suggest that the rice markets at these stages are competitive and performing well. However, substantial positive net returns are left for Upcountry brokers and Kampala wholesalers. Does this mean that the rice markets at these stages are not competitive to the extent that they eliminate positive profit in spite of the large number of traders, or has the cost accounting neglected some important cost items?

Indeed, an important cost item, the cost of bearing risks inherent in marketing, is missing from the cost accounting in Table 6 because of the lack of data. Rice traders face various risks such as unexpected price changes, misjudgments on quality, theft and traffic accidents, for all of which no formal insurance system is available. Above all, the risk of theft, accident and quality deterioration during long-distance transportation is serious for Upcountry brokers and Kampala wholesalers. Studying crop marketing in three SSA countries, Fafchamps (2004) found that traders lost 2.5 per cent of the total value of sales because of theft during transport. If the same rate of risk is assumed for Uganda, traders' net return is totally eliminated: –USh1/kg for Upcountry brokers and –USh7/kg for Kampala wholesalers. Using these estimates, the total traders' net return for the whole post-harvest marketing chain is –USh11/kg or −1 per cent of the total price spread. Thus, our cost accounting suggests that the post-harvest rice marketing chain in Uganda is competitive and does not allow traders to reap excess margins.[17]

Table 7 summarises the accounting results in terms of the rate of returns for traders' investment. For village-level traders and Kampala retailers who face relatively less risks, the rates of return which are estimated without taking risk into account are close to the opportunity interest rate of 27 per cent per year. For Upcountry brokers and Kampala wholesalers, the rates of return with risk are also comparable to the opportunity interest rate. Such results suggest that the rice markets, including the associated capital market, perform reasonably well.

Table 7. Rates of traders' returns, Uganda, 2012

	Net margin ratio[a]	Rate of return with the mean gestation period[b]	
		No risk[c]	With risk[d]
	%	..... %/year	
Village level trader	2.3	28.2	
Upcountry broker	4.9	69.1	26.5
Kampala wholesaler	4.8	67.5	23.9
Kampala retailer	2.4	29.2	

Notes: [a]Net margin/acquisition price, where net margin = capital interest + trader's net return computed from Table 6.
[b]The rates of return for traders' net margins with a mean procurement interval of 1.1 months (Table 3) as the gestation period of their investments. Computed as r in the following formula: $r = (1 + (NM/I))^{(12/n)} - 1$, where NM = net margin, I = trader's investment (= acquisition price + marketing costs not including the capital interest), and n = gestation period of the investment. For comparison, the opportunity interest rate is 27 per cent per year.
[c]No risk for traders is taken into account.
[d]Traders' gross revenue (= their selling price) is discounted for risk, assuming that theft, accident, and quality deterioration during transport reduce the revenue by 2.5 per cent, based on Fafchamps (2004, pp.112–114).

In this regard, how does the Ugandan rice market compare with the experience in other countries? The cost accounting, including capital interest, for rice wholesalers in Nigeria by Jones (1972) left 12 per cent of the acquisition price as surplus, more than four times higher than our Ugandan case. Dawe et al. (2008) revealed that no surplus was left to rice traders in Thailand after deducting marketing costs including capital interests, while a substantial surplus was left in the Philippines. Other earlier studies which tried crop-marketing cost accounting gave only the net margin (gross margin minus marketing costs apart from capital interests). The ratio of the net margin to the acquisition price was reported to be 5–9 per cent for rice in Ghana (Timmer et al., 1983), 3–7 per cent for maize in Ghana (World Bank, 2007) and 7–25 per cent for food crops in Benin, Malawi and Madagascar (Fafchamps et al., 2005). The same ratio for rice traders in Uganda ranges from 2.3 to 4.9 per cent (Table 7). It appears that the seemingly competitive crop markets in some SSA countries may leave excessive returns to crop traders. For example, 16 per cent (the median of 7–25 per cent) of the net margin ratio corresponds to 405 per cent per year of the rate of return, if the gestation period of traders' investments is as short as 1.1 months as in Uganda. Such a high rate of return could be beyond the opportunity interest rate for crop traders in any circumstances.

7. Conclusions

Using the data obtained from nation-wide market surveys, the structure of the indigenous markets for domestic rice in Uganda was examined for the whole of the marketing chain from the farm gate in rice-producing areas to retail outlets in Kampala. The national rice market, consisting of five market stages, has a simple structure in terms of the number of 'brands' transacted. The market at each stage of the marketing chain is competitive in the text-book sense: a large number of traders participate, with no entry barrier, in the buying and selling of rice for cash, and the law of one price prevails. The accounting for costs inherent in the marketing process, including capital interests and risk premiums, leaves no surplus for traders at all stages of the marketing chain. Overall, our study suggests that the rice market in Uganda, a spontaneously developed indigenous market without any government intervention, which operates, in other word, under a laissez-faire policy, is competitive and working well.[18]

The literature is in agreement about the fact that the food crop markets in SSA are competitive and work well in forming prices, and in this regard the rice market in Uganda is not an exception. In contrast, the literature says little about whether the crop markets are perfectly competitive in order to eliminate excessive returns to crop traders. Although there have been a limited number of studies which attempted cost accounting of the crop marketing chains in SSA, these studies, unlike ours, seem to suggest that substantial surpluses beyond normal profit were left to crop traders. The question of whether large numbers of competitive traders ensure the good performance of crop markets (Dawe et al., 2008) remains to be answered. The results of this study were obtained based on small samples and many heroic assumptions, and demand further confirmation. However, it is hoped at least that this study provides some benchmark data for future research.

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Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. The same view in tropical Asia is well described by Siamwalla (1992).
2. The paucity of the literature in this respect is not limited to SSA. With some exceptions (Dawe et al., 2008; Hayami, Kikuchi, & Marciano, 1999), it is rare to see market studies of this kind in other developing regions.
3. It is symbolic that the source of data on margins and costs involved in the post-harvest marketing chain between the farm gate and the urban retail market for maize in Ghana referred to by World Bank (2007, p.119), which emphasises the important roles to be played by crop markets in agricultural development, is not a published source but one of 'personal communication'.
4. This quantity includes rice consumed in institutions, such as restaurants and hospitals.
5. Note that the supermarkets' share was only 8 per cent (4/52) even for imported rice.
6. The size of grain differs among the three rice varieties, but the poor quality of rice milling in Uganda, which produces milled rice with full of broken rice, makes it possible to mix up non-Supa varieties with Supa.
7. For example, if a Kampala wholesaler purchases 100 sacks, the cash payments involved could be more than USh30 million (approximately US$12,000).
8. More than 70 per cent of the rice procured by Kampala wholesalers is from these two regions (Kikuchi et al., 2013).
9. Trucks used for transporting rice usually have carrying capacities of 5–6 t (50–60 sacks), 10 t (100 sacks) and 20 t (200 sacks). The traffic regulations in Uganda do not allow any truck load greater than 20 t. For domestic transport for rice and other agricultural products, containers are not used.
10. The data on transport cost for grains in Uganda presented in Rashid and Minot (2010) gives −0.76 for this elasticity.
11. Other factors which may affect the cost, that is, the size of sack (100 kg sack or not), the road condition (poor or not), and the short transportation distance (less than 30 km or not), were all found statistically insignificant.
12. Brokers/suppliers and retailers usually have neither office spaces nor cash counters. Few wholesalers keep office spaces; they usually have cash counters which are usually unimposing with negligible depreciation values.
13. This interest rate was comparable to the interest rates on credit to the private sector of Microfinance Deposit Taking Institutions (BOU, 2011).
14. The limited number of money borrowing cases does not necessarily imply that the money market does not function well. Sample rice traders and millers generally began their businesses by self-financing or borrowing from relatives and friends, and their complaints about financing were not as significant as expected.
15. The share of transport costs in the total margin was 18 per cent for rice in Ghana (Timmer et al., 1983), 37 and 13 per cent for food crops in Benin and Malawi (Fafchamps et al., 2005), and 26 per cent for maize in Ghana (World Bank, 2007). The share of transport costs seems to have declined significantly in the last few decades. Martin (1963) reported that transport costs took 20 per cent of the retail price of maize in the late 1950s in Uganda. The significant decline in transport costs in SSA in recent years is not limited to Uganda (Rashid & Minot, 2010).
16. The factor shares of post-harvest rice marketing services are estimated as follows: current inputs (16%); labour (32%); land and property (10%); capital including traders' net returns (42%) (Kikuchi et al., 2014).
17. The price data used in this section is for March–April, when the rice price was higher than during the peak harvesting season. With each marketing cost enumerated being more rigid than the rice price, the net traders' return should have been lower in the peak season.
18. Market integration is not limited to the indigenous markets: The rice market formed by supermarkets is integrated with the national rice market and competes with rice retailers in the indigenous markets (Kikuchi et al., 2015).

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