

*Full Length Research Paper*

# **Pig marketing and factors associated with prices and margins in Western Kenya**

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Accepted 11 December, 2013

**This study evaluated the marketing margins and profits of local pig marketing enterprises in Western Kenya. A unique set of data on pig prices, pork prices, marketing costs, the operational practices and socio-economic characteristics of butchers were collected from 49 pig butcher enterprises in four purposively chosen divisions in Western Kenya. Mean marketing and profit margins ranged from 27 to 41% and 5 to 10%, respectively, depending on the weight category of the pig purchased. There was a moderate (0.59) correlation ( $p < 0.001$ ) between the butchers' ranking of the pork price charged to customers and their profit. Mixed models and generalized linear models were used to assess factors associated with five outcomes: pork prices charged to consumers, pig prices paid to farmers, marketing and operating costs, marketing margins, and profits. In this study, pig weight, division and education level were associated with most outcomes. Butcher profits were moderate. Butchers operating in larger volume markets charged higher pork prices and earned higher profits. Farmers received lower prices per kg for pigs that were smaller (22 kg) than the mean market weight of 30 kg. Capital constraint, the need for personal negotiations and the absence of contracts limit the marketing capacity of pigs and the returns available to butchers and farmers.**

**Key words:** Pigs, butchers, smallholder farmers, marketing, margins, profit, Kenya.

## **INTRODUCTION**

Efficient marketing plays a critical role in economic development and poverty alleviation (Fischer and Qaim, 2012; Ajala and Adesehinwa, 2008; Timmer, 1995; Diao et al., 2003). Despite marketing reforms of the 1980s, farmers in Sub-Saharan Africa (SSA) still face dismal marketing conditions because of remoteness, high risks of trade, underdeveloped financial, institutional and physical infrastructure, and an underdeveloped private sector (Poulton et al., 2006; Shiferaw et al., 2011; Kydd and Dorward, 2004, Fischer and Qaim, 2012; Minten and Kyle, 2000; Gabre-Madhin, 2001).

This study focuses on the marketing margins as a proxy for the performance of pork value chains in rural and peri-urban settings of Western Kenya. High transport costs and the high standards of urban processing centers limit smallholder farmers to selling pigs to local butchers (Kagira et al., 2010a; FAO, 2012). The FAO (2012) claim pig butchers offer farmers 'low and exploitative prices'.

"Exploitative" might suggest that the market is not competitive (Ajala and Adesehinwa, 2008; Marsh and Brester, 2004); physical marketing costs such as transport, travel and storage are high (Fafchamps et al., 2005); or pig butchers require significant compensation for the opportunity cost of invested capital, risks of trade, and transaction costs, which are prominent in SSA (Gabre-Madhin, 2001; Minten and Kyle, 2000).

In Nigeria, Ajala and Adesehinwa (2008) studied the performance of pig marketing in rural and urban markets and reported an average marketing margin (cost of marketing services as a proportion of the consumer price) of 39%. The market structure is oligopolistic which the

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authors attributed to the large amount of operating capital required by marketing agents. Marketing agents with high levels of education, better access to financial capital, who make regular use of brokers, have repeated interaction with suppliers and customers (better social networks) often earn higher profit margins (Minten and Kyle, 2000; Fafchamps et al., 2005; Ajala and Adesehinwa, 2008; Jabbar et al., 2008; Abankwah et al., 2013; Toure and Wang, 2013; Nganga et al., 2010). Ajala and Adesehinwa (2008) also noted the importance traders placed on pig weight when evaluating pig price. However, the impact of pig weight on marketing margins has not been quantified. Addressing this gap, we hypothesize that pig weights will impact the prices farmers receive, butchers' profits and the marketing margin.

In this study, we evaluated pig prices, pork prices, marketing costs, profitability, marketing margins and butcher-related factors associated with them. Using a unique data set of 49 pig butchers, respondents were first categorized into low, medium, and high profitability groups and the components of net income that differed among the groups were determined. Using regression analysis, we examined specific butcher characteristics and operating practices associated with pork price, pig price, marketing and operating costs, butcher profit, and marketing margins. This analysis was essential to determine the factors which impact butchers, farmers, and consumers in local marketing chains and to identify opportunities to improve pork marketing and the welfare of stakeholders.

## **MATERIALS AND METHODS**

### **Study location**

Four divisions in the Western Province of Kenya: Butula, Funyula, Ikolomani, and Shinyalu were selected because of their large population of pigs, history of pig keeping, and high prevalence of poverty (Mutua et al., 2011a; Kagira et al., 2010b). Butula and Funyula are located approximately 30 km apart within Busia District, a rural area, with a population of 488,075 (Anonymous, 2009a). Butula has larger, more trafficked market places than Funyula and is situated closer to the city of Busia in Busia District. Shinyalu and Ikolomani are located approximately 9 km apart in the peri-urban Kakamega District (population of 1,660,651) (Anonymous, 2009a). Shinyalu has larger, more trafficked market places than Ikolomani, with most butchers situated on or near the main road between Kakamega, a city of 100,000 in Kakamega District, to Kisumu, a city of 400,000 in Kisumu District.

### **Pork marketing chain**

There are no central markets for trading live pigs in Kenya (FAO, 2012). This is likely attributed to the limited

volume of pigs and high transport costs for shipping pigs to urban centers and because most pigs in rural locations do not meet the standards of urban processing plants (Kagira et al., 2010a). Pigs are traded at the farm-gate (FAO, 2012) based on a negotiated price between the farmer and butcher. The pork is sold locally by the pig butchers. Butchers are required by law to have their pork inspected by government inspectors.

### **Survey**

A structured price sheet was designed to elicit pricing information from butchers on their revenues, marketing and operating costs, and pig prices in order to evaluate each pig butcher's net income statement. Revenue items included the per kg pork price posted in the butcher shop, any premium charged for cooking pork, and a line item for each additional revenue from pig parts (including the head, feet, legs, ears, tongue, heart, kidney, liver and lungs) that a butcher sold at a different price than the posted pork price. Marketing items included transportation, slaughter, agent use, inspection of pork, labour, cooking costs, and amenities on a per pig basis. Operating cost items included yearly license fees and monthly rent. Pig prices were collected by having butchers provide an average price they pay farmers for a live pig weight of 22, 30, 35 and 45 kg, or the corresponding dressed weight of 16, 22, 26 and 33 kg respectively. The weight categories provided to butchers were based on the 25th, 50th, and 75th percentile weights (22, 30 and 35 kg) for pigs in Busia at market age (5.1 to 9.9 months) (Mutua et al., 2011c) and a median breeding pig weight of 42 kg (Mutua et al., 2011b). In the study by Mutua et al. (2011c), pigs were weighed by researchers using weight scales in order to develop a tape measure system for estimating pig weights. The tape measure and weight chart tables were provided to farmers one year before this study began. The uptake of the tape measure method by pig farmers has not been studied. Butchers can weigh pigs after slaughter as weight scales are available at slaughter slabs.

To assess factors associated with the pig prices (paid to farmers), pork prices (charged to consumers), marketing and operating costs, butcher profits, and marketing margins, an accompanying questionnaire was developed with three sections. The first section included questions on butcher characteristics including age, years of experience, education, and location of shop. The second section contained general questions to attain the butchers' operational practices including hours of travel per day, number of pigs purchased per month, use of agents, use of cell phone, contractual agreements, credit access, and marketing type (sells cooked pork or only raw pork). The third section gathered information on the butchers' assets including the number of telephones, bicycles, availability of electricity and piped water,

armchair sets, water tanks, generators, glass windows, wheelbarrows, hand carts, motorcycles, latrines, radios, televisions, and clocks.

### Sampling frame

An enumeration of all pig butchers in the retail market locations within the four study divisions was carried out in 2008-2009 with the help of government meat inspectors, pig farmers, village elders, and other pig butchers. All enumerated butchers were invited to participate in the interview. Pig butchers were initially contacted by a village elder or a government inspector who described the research study. In total, 25 butchers in Busia and 26 in Kakamega were enumerated. One butcher could not be reached in 2008 or 2009 and one butcher was excluded from this study because he was unable to provide pig purchase prices for any of the provided pig weights.

### Data analysis

All collected data were entered into Microsoft Excel 2007 (Microsoft, Redmond, WA, USA), and descriptive tables were created using SAS 9.1 (SAS Institute, Cary, NC, USA). Net income statements for each butcher were produced, and each butcher was placed into a low, medium, or high profit category. Butchers with an average net income per kg of less than zero were assigned to the low-profit group. Butchers in the upper 75<sup>th</sup> percentile of average net income per kg were assigned to the high-profit group, and the remaining butchers were assigned to the medium-profit group. Analysis of variance (ANOVA) was used to determine which cost components of the net income statement differed by profit group, using the year of interviewing as a fixed effect to control for price variation between years. Statistical significance was assessed by the overall F-test, followed by the t-test comparison among different profit groups.

The level of competition was evaluated using a concentration ratio (Ajala and Adesehinwa, 2008):

*Concentration ratio = sales volume of pig purchases in a year of largest four firms / total volume for all butchers \*100*

A concentration ratio of less than 33% is considered competitive as the highest volume of butchers who do not sell the majority of the pigs in the market. The concentration ratio was calculated for each district (Busia and Kakamega), and each division (Butula, Funyula, Shinyalu and Ikolomani).

The pork price for consumers, pig price and marketing margins (of interest to farmers), marketing costs and profits for butchers are vital indicators for participation and impact the sustainability of local market chains.

Determining the factors associated with the variation in these prices, costs and profits will provide a more comprehensive understanding of the marketing value chain than cost structures alone. To determine the associations, regression was used, and it took the forms:

$$Y_i = a + b_i X_i + E_i$$

where Y is the outcome variable of interest (either pork price, pig price, marketing and operating costs, butcher profit or the marketing margin, all measured on a per kg basis);  $X_i$  is the vector of independent variables which are outlined in Table 1; b is the vector of corresponding parameter estimates; a is the intercept; and  $E_i$  is the error term. For the dependent variables of pig price, marketing and operating costs, profit, and marketing margin, there were four observations per butcher because butchers provided their price for each pig weight category (22, 30, 35 and 45 kg). To account for the dependence between observations at the butcher level, individual butcher identification was included as a random effect, blocking on pig weight category. We therefore chose a general linear mixed model (GLMM) which was fit in SAS 9.1 (SAS Institute, Cary, NC, USA). Unequal variance was allowed for by pig weight, because residual plots suggested unequal variances. Significance was assessed at  $p < 0.05$ . Independent variables were first screened using a significance level at  $p < 0.25$ . Manual backwards elimination was employed to reach reduced final models. An ICC was calculated for each reduced model to determine the random variation attributable to the butcher for each pig weight. Several plausible interactions were evaluated during the model building process including division and hours of travel, division and education level, and years of experience and education level. Residuals of each categorical variable were visually evaluated for homoscedasticity. Residuals were also assessed to test for linearity using a Shapiro-Wilk W statistic. The linearity assumption was not met according to the Shapiro-Wilk W statistic; however the histogram of the residuals appeared bell-shaped after plotting. The same models were also run using logarithmic transformations on the outcome variables and continuous independent variables but the residuals were not normally distributed based on Shapiro-Wilk statistic. Models with non-transformed outcome variables were presented for simplicity of interpretation.

For the dependent variable pork price per kg, it was not necessary to block on weight, as butchers charged one pork price regardless of the weight of the pigs they purchased. Since there was only one observation per butcher, a general linear model was fit to assess the associations between the independent variables outlined in Table 1 and the pork price per kg. Independent variables were first screened using a significance level at  $p < 0.25$ . Manual backwards elimination was employed to reach a reduced final model. Linearity and

**Table 1.** Independent variables collected in butcher interviews in Western Kenya (2008-2009) and assessed in models on the outcomes of pig price per kg, pork price per kg, marketing and operating costs per kg, profit per kg, and marketing margin per kg.

Variable	Description	Type
<b><i>Butcher characteristics</i></b>		
Age	Age of the butcher	Continuous
Asset score	An asset index variable used to proxy butchers' social economic position was derived using the asset-based approach as described by Morris et al. (2000) and the asset questions from the third section of the survey	Continuous
Butcher ID	A unique identifier for the butcher treated as random effect variable	Categorical
Division	The division the butcher operated out of. (Butula, Funyula, Ikolomani, Shinyalu*)	Categorical
Education	The coded education level of the butcher into 3 categories (no education/incomplete primary; completed primary, or at least two years of high school up to college education*)	Categorical
Experience	Years of experience the butcher had in the pig butcher enterprise	Continuous
<b><i>Operating or marketing practices</i></b>		
Agent use	The percentage of purchases a butcher paid agents to help find pigs.	Continuous
Contract	Whether the butcher had any agreements with farmers (yes* or no)	Categorical
Hours of travel	Hours of travel time the butcher spent per day searching for pigs	Continuous
Marketing type	Whether the butcher sold raw pork only or both raw and cooked pork (raw* or cooked)	Categorical
Pigs per year	The number of pigs that a butcher purchased in a year	Continuous
Phone	Use of phone for business (yes* or no)	Categorical
<b><i>Price components of net income statement</i></b>		
Marketing costs+	The total marketing costs per kg excluding pig price.	Continuous
Operational costs+	The operational costs per kg	Continuous
Pork price+	The price the butcher charged in his shop for raw pork per kg in KES	Continuous
Pig price+	The price butchers reported to be paying farmers for the pig per kg (live weight) in KES	Continuous
<b><i>Control variables</i></b>		
Interview year	The year that the butcher was most recently interviewed (2008 or 2009*)	Categorically
Weight	Weight of the pig being purchased in kg (22, 30, 35, 45*). All butchers were asked for the price they would typically pay for a pig that has same size	Categorical

\*referent variable in model;

+ not used to model the outcome profit per kg because variable was used in the derivation of profit per kg.

homoscedasticity assumptions were met for the general linear model, using a Shapiro-Wilk W statistic, and visual inspection respectively.

## RESULTS AND DISCUSSION

### Butchers, their characteristics, and operational practices

In total, 49 butchers were included in this study. Table 2 provides a summary of butcher characteristics and operational practices by profit group. Butula in Busia and Shinyalu in Kakagmege had the highest concentration of butchers and all of the butchers in the high profit group. These two divisions were observed to have the highest trafficked market centers; they also have the highest

populations and are closer in proximity to the major cities within their respective districts. Conversely, no butchers from Funyula or Ikolomani were in the high profit group. These two divisions were observed to have the lowest trafficked market centers. They also have the lowest populations and are situated furthest from the city centers within their corresponding districts.

The education levels of the butchers varied. Approximately one third (34.7%) had no formal education or a few years of primary school; 36.7% had completed primary education; and 28.6% had at least some high school education (Table 2). However, 60% of the butchers in the high profit group had at least some high school education (Table 2).

More than half of the butchers sold cooked pork in their enterprise (Table 2). Cooked pork was sold by 79% of

**Table 2.** The characteristics and operating practices of 49 pig butchers in Western Kenya, 2008-2009.

Item	All butchers % (n = 49)	Butchers by profit group		
		Low % (n = 16)	Med % (n = 18)	High % (n = 15)
<b>District/Division</b>				
Busia/Butula	40	19	41	60
Busia/Funyula	12.5	31	6	0
Kakamega/Ikolomani	12.5	19	18	0
Kakamega/Shinyalu	35	31	35	40
<b>Education Level</b>				
Less than primary	34.7	37	44	20
Completion of primary	36.7	44	44	20
Completion of at least 2 years secondary	28.6	19	11	60
<b>Use of Telephone</b>				
Uses telephone for business	83	88	89	72
Does not use telephone for business	17	12	11	28
<b>Marketing of pork</b>				
Raw only	43	25	56	45
Cooked and raw	57	75	44	54
<b>Access to credit</b>				
	0	0	0	0
<b>Piped water or water tank</b>				
	12	12	11	13
<b>Electricity</b>				
	0	0	0	0
<b>Contracts with farmers</b>				
	16	1	27	1
Age of butchers (years)	36.6 (11.1)	36.8 (11.5)	37.7 (10.9)	35.8 (11.5)
Years of experience	8.6 (7.7)	7.2 (6.1)	10.4 (9.2)	7.8 (7.3)
Hours of travel per day	5.4 (3.4)	5.3 (3.2)	5.4 (3.9)	5.6 (2.9)
Pigs purchased per year	209 (73.9)	209 (91.9)	223 (47.8)	193 (78.3)
Asset score	0.28 (0.30)	0.19 (0.17)	0.37 (0.41)	0.27 (0.22)
Percent of pigs purchased through an agent	34.5 (27.2)	41.3 (29.5)	39.1 (30.1)	23.1 (19.5)

Source: Data collected (2008 and 2009).

Profits for butchers placed into low, medium and high profit groups were -27.7 to 0 KES per kg, 1 to 20 KES per kg, and 21 to 42 KES per kg respectively.

butchers that operated in the Busia District. Butchers in Kakamega reported informally that most of them do not provide cooked pork due to low demand in that district.

No butcher reported having access to credit or electricity, and a small proportion of butchers had piped water (Table 2). In the absence of capital, electricity, and running water, butchers lack the ability to process meat. The absence of value-added processing has been noted to limit market expansion in developing markets of SSA (Gabre-Madhin, 2001).

A small proportion of butchers (16%) had contracts with farmers; the contracts were simply verbal agreements to buy market weight pigs from farmers without delivery standards or any commitment to prices. Absence of contracts increases transaction costs of trading in SSA because personal travel increases to compensate for lack

of co-ordination, and costs of assessing an unknown trading partner's trustworthiness increase (Fafchamps et al., 2005). The age and experience of butchers was homogenous across profit groups (Table 2); however 22% of the butchers interviewed had less than 2 years of experience. Butchers purchased pigs almost daily, with a third of the pigs being purchased through an agent (Table 2).

### Competitiveness

By district, the concentration ratio (a measure of competitiveness) for Busia and Kakamega was 24 and 26% respectively, indicating a competitive market structure. When evaluated by division, the concentration ratio for Butula, Funyula, Ikolomani and Shinyalu was 29,

75, 33 and 75%, respectively indicating Funyula and Shinyalu to be more oligopolistic. As butchers travel 5 h (Table 2) or 25 km per day (Levy et al., 2009) searching for pigs, it is likely most appropriate to assume that butchers within each district compete with each other for purchasing pigs, so we conclude that purchasing pigs is competitive because of the low concentration ratio by district. With respect to selling pork, consumers are not likely to travel the same distances as butchers to purchase pork, so evaluating concentration ratio by division is likely more appropriate. The higher concentration ratios in the rural divisions would indicate that Funyula and Shinyalu butchers have greater opportunity to act as oligopolies than their urban counterparts in terms of pork sales. However, pig butchers are also thought to be competing with beef and chicken prices which could make them act more competitively. Kagira et al. (2010a) suggested that pork prices are lower during the wet seasons when fish and beef supply is high. Pork is also likely to have high income elasticity particularly in very rural locations where there are high levels of poverty which should limit any price fixing practices. The barriers to entry included a yearly business license fee and a health license fee. Working capital to purchase pigs was also required.

### **Net income statement and differentiating profit groups**

Table 3 provides revenues, pig prices, marketing costs, operating costs, and profit on a per kg basis for butchers categorized by profit group for each pig weight (22, 30, 35 and 45 kg live weight). Prices with different superscripts within each weight category are statistically different from one another.

### **Revenues**

The revenues from pork sales ranged from 86 to 93% of the total revenue earned from a pig, depending on the pig weight and the butchers' profit group (Table 3). The remaining revenue came from selling additional pig parts which ranged from 7 to 14% of the total revenue (Table 3). Butchers in the high and medium profit groups were charging a higher pork price than butchers in the low profit group (Table 3). The pork prices charged to consumers varied more than any of the other prices in the net income statement (Table 3). In 93% (56/60) of the pig purchases that had negative profits, the butcher was charging less than the mean pork price of the butcher population (after adjusting for the year of purchase). The variation in pork prices is likely driven by the demand for pork in the various market locations, which are spread over large distances. Some price fixing may occur, as there is less competition for pork selling in rural locations, but as discussed earlier, butchers are most likely acting competitively. The butcher related factors associated with

pork prices are further assessed and discussed as this study progresses.

### **Costs**

Pig price accounted for 61 to 81% of the butchers' total costs (Table 3). Butchers in the high profit group offered lower prices for smaller (22 kg) pigs than butchers in low and medium profit groups. The 30 kg pig price did not differ significantly between profit groups (Table 3). Butchers in the low profit group offered higher prices for larger (35, 45 kg) pigs than the medium and high profit butchers (Table 3). In 76% (46/60) of the pig purchases that had negative profits, the butcher offered more than the mean pig price per kg for pigs in each weight class, after adjusting for the year of purchase. Variation in pig prices between butcher profit groups likely reflects the pig supply in the locations butchers operate and butchers' ability to assess the value of pigs at different weight levels. Butchers in Kakamega have reported greater challenges in finding pigs than butchers in Busia (Levy et al., 2009). While pig purchasing is likely competitive, farmers still need to have good price information when selling pigs at the farm-gate as the price is determined by negotiation. Butchers reported that some farmers invite multiple butchers to their farm when selling a pig to gain pricing information and to promote competition.

Marketing costs and operating costs as a proportion of total revenue ranged from 15 to 37% depending on the pig weight and butcher profit group (Table 3). Within each profit group, marketing and operating costs decreased with pig weight, because slaughter, inspection and transport costs are charged on a per pig, rather than a per kg, basis. This suggests that butchers can economize costs by purchasing larger pigs (Table 3). Butchers in the high profit group had significantly lower transport and slaughter slab costs than those in the low and medium profit categories (Table 3). Slaughter slabs are privately owned and different arrangements exist for use of water and labour which could explain differences in costs. Transport costs may also be influenced by butchers' proximity to slaughter slabs and better infrastructure near larger cities.

### **Profit**

The net income of butchers differed significantly by profit group for each pig weight category (Table 3). The mean profits ranged from -9.7 to 30.5 KES per kg (Table 3). Thirty-three percent (60/182) of pig purchases were not profitable. In 10% (19/182) of pig purchases, the price offered for the pig exceeded the potential revenue from the pork and 43% (21/49) of butchers had at least one unprofitable purchase, indicating that some butchers did not always calculate a break-even price for their pig purchases even when they were provided the pig weights by researchers. The variation in profitability and the high

**Table 3.** Net income (per kg) in Kenyan shillings for butchers categorized into low, medium, and high profit groups for purchases of pigs weighing 22, 30, 35, and 45 kg (live weight) in Western Kenya, 2008-2009.

Profit Group	22 kg			30 kg			35 kg			45 kg		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
<b>Revenues</b>												
Pork price (posted in shop)	125 <sup>a</sup>	144.7 <sup>b</sup>	145.5 <sup>b</sup>	127.5 <sup>a</sup>	143.9 <sup>b</sup>	153.8 <sup>b</sup>	127.5 <sup>a</sup>	143.9 <sup>b</sup>	153.8 <sup>b</sup>	127 <sup>a</sup>	144 <sup>b</sup>	154 <sup>b</sup>
Adjusted pork price *	93.8 <sup>a</sup>	108.5 <sup>b</sup>	111.6 <sup>b</sup>	95.8 <sup>a</sup>	107.9 <sup>b</sup>	117.4 <sup>b</sup>	95.8 <sup>a</sup>	107.9 <sup>b</sup>	117.4 <sup>b</sup>	95.8 <sup>a</sup>	108.1 <sup>b</sup>	118.3 <sup>b</sup>
Additional pork parts **	14.7	18.3	17.6	10.7	12.6	12.6	9.2	10.8	10.8	7.2	8.7	8.6
<b>Total Revenue (A)</b>	<b>108.5</b>	<b>126.8</b>	<b>129.2</b>	<b>106.5</b>	<b>120.5</b>	<b>130</b>	<b>105</b>	<b>118.7</b>	<b>128.2</b>	<b>103</b>	<b>116.8</b>	<b>126.9</b>
<b>Costs</b>												
Pig price	73.9 <sup>a</sup>	74.2 <sup>a</sup>	62.9 <sup>b</sup>	85.7	80.4	79.5	89.2 <sup>a</sup>	81.0 <sup>ab</sup>	79.1 <sup>b</sup>	89.7 <sup>a</sup>	79.7 <sup>b</sup>	78.7 <sup>b</sup>
<b>Marketing costs</b>												
Agent	2.2	2.2	1.1	1.5	1.7	0.9	1.3	1.4	0.8	1.0	1.2	0.7
Transport	7.1 <sup>a</sup>	9.7 <sup>a</sup>	5.7 <sup>b</sup>	5.6 <sup>a</sup>	6.8 <sup>a</sup>	3.9 <sup>b</sup>	4.8 <sup>a</sup>	5.9 <sup>a</sup>	3.3 <sup>b</sup>	3.7 <sup>a</sup>	4.5 <sup>a</sup>	2.8 <sup>b</sup>
Slaughter	6.5 <sup>a</sup>	8.9 <sup>a</sup>	5.9 <sup>b</sup>	5.1 <sup>a</sup>	6.0 <sup>a</sup>	4.5 <sup>b</sup>	4.3 <sup>a</sup>	5.2 <sup>a</sup>	3.8 <sup>b</sup>	3.4 <sup>a</sup>	4.2 <sup>a</sup>	3.0 <sup>b</sup>
Inspection	3.7	4.3	3.7	3.1	2.9	2.6	2.6	2.5	2.2	2.0	2.0	1.7
Labour	10.4	8.6	7.2	7.1	6.3	5.8	6.0	5.4	5.0	4.7	4.2	4.1
Cooking	4.2	3.6	4.4	2.7	2.7	4.0	2.3	2.3	3.5	1.8	1.8	2.9
Amenities	2.9	3.7	4.0	2.0	2.5	2.8	1.7	2.2	2.4	1.3	1.7	1.9
<b>Operating costs</b>												
License/Fees	1.3	1.4	1.7	1.0	1.0	1.1	0.8	0.9	1.0	0.6	0.7	0.7
Rent	2.5	3.6	2.1	1.9	2.5	1.9	1.7	2.1	1.6	1.3	1.7	1.3
<b>Marketing + Operating</b>	<b>40.8</b>	<b>46</b>	<b>35.8</b>	<b>30</b>	<b>32.4</b>	<b>27.5</b>	<b>25.5</b>	<b>27.9</b>	<b>23.6</b>	<b>19.8</b>	<b>22</b>	<b>19.1</b>
<b>Total costs (B)</b>	<b>114.8</b>	<b>120.2</b>	<b>98.7</b>	<b>115.7</b>	<b>112.8</b>	<b>107</b>	<b>114.7</b>	<b>108.9</b>	<b>102.7</b>	<b>109.5</b>	<b>101.7</b>	<b>97.8</b>
<b>Net Income per kg (A-B)</b>	<b>-6.3<sup>a</sup></b>	<b>6.6<sup>b</sup></b>	<b>30.5<sup>c</sup></b>	<b>-9.2<sup>a</sup></b>	<b>7.7<sup>b</sup></b>	<b>23<sup>c</sup></b>	<b>-9.7<sup>a</sup></b>	<b>9.8<sup>b</sup></b>	<b>25.5<sup>c</sup></b>	<b>-6.5<sup>a</sup></b>	<b>15.1<sup>b</sup></b>	<b>29.1<sup>c</sup></b>
<i>Net Income per pig</i>	<i>-138<sup>a</sup></i>	<i>145<sup>b</sup></i>	<i>671<sup>c</sup></i>	<i>-276<sup>a</sup></i>	<i>231<sup>b</sup></i>	<i>690<sup>c</sup></i>	<i>-339<sup>a</sup></i>	<i>343<sup>b</sup></i>	<i>892<sup>c</sup></i>	<i>-292<sup>a</sup></i>	<i>679<sup>b</sup></i>	<i>1309<sup>c</sup></i>

Source: Data collected (2008 and 2009) and calculated (2012).

\*Adjusted pork price (adjusted for difference between live and dressed weight) = pork price charged in shop \* 0.75.

\*\* Additional pig parts = sum of pork parts sold separately / live pig weight.

<sup>a,b</sup> Different superscripts within each weight class differ by profit group ( $p < 0.05$ ).

The exchange rate to convert Kenyan shilling (KES) to US dollar (USD) is 0.01278 KES = 1 USD (Anonymous, 2009b).

proportion of negative profits experienced by butchers in this study is not unusual for marketing systems of SSA (Minten and Kyle, 2000; Toure and Wang, 2013; Fafchamps et al., 2005).

Table 4 presents the correlation coefficients between the price components of the net income statement and profit. There was a moderate (0.59) correlation ( $p < 0.001$ ) between the butcher

rankings for pork price charged per kg and profit earned per kg (Table 4). There was a moderate (-0.51) correlation ( $p < 0.001$ ) between the butcher rankings for pig price per kg and profit earned

**Table 4.** Spearman correlation coefficients of prices on butchers' profit per kg for 22, 30, 35 and 45 kg pig purchase weights in Western Kenya, 2008-2009.

Parameter	22 kg	30 kg	35 kg	45 kg	All kg
Pork price	0.59 *	0.58 *	0.58 *	0.62 *	0.59 *
Additional pig parts revenue	0.26	0.22	0.08	0.06	0.10
Pig price	-0.56 *	-0.47 *	-0.46 *	-0.57 *	-0.49 *
Agent	0.04	-0.19	-0.21	-0.16	-0.16
Transport	-0.17	-0.30*	-0.21	-0.19	-0.26 *
Slaughter	-0.11	-0.08	-0.07	0.00	-0.11
Inspection	0.14	-0.26	-0.23	-0.26	-0.17 *
Labour	-0.21	-0.06	-0.03	0.001	-0.11
Cooking	-0.27	-0.06	-0.00	0.13	-0.06
Amenities	0.14	0.23	0.19	0.14	0.09
Total Marketing	-0.25	-0.17	-0.08	0.01	-0.19
Licenses	0.04	-0.07	0.08	0.06	-0.05
Rent	0.01	-0.03	-0.15	-0.14	-0.10
Total operating	0.11	-0.03	-0.11	-0.11	-0.06

Source: Data collected (2008 and 2009).

\*significant at  $p \leq 0.05$ .

per kg (Table 4). The results indicate the dependence of butcher profits on pig price and pork price.

### Margins

Table 5 provides the profit margins and marketing margins grouped by pig weight, division and education. The average profit margin for all of the butchers was 7, 5, 6, and 10% for 22, 30, 35, and 45 kg pigs, respectively (Table 5). The interest rate in Kenya at the time of the study was between 8 and 9% (Anonymous, 2009c). On average, pig butchers were not acting exploitatively as they were earning profits comparable to the cost of acquiring the capital to purchase pigs. Abankwah et al. (2013) used the same approach for the fertilizer market in Ghana and concluded that marketing agents were not exploitative (Abankwah et al., 2013).

Butchers in Butula and butchers with at least some high school education earned profit margins of up to 17 and 18% respectively for some pig weight categories (Table 5). The higher margins might be justified to compensate butchers for their transaction costs (pig search, personalized negotiation, and arranging transport for single purchase). Also the risks of trade such as having pork condemned at inspection or pigs perishing during transport may justify higher profit margins. It is also possible that some butchers are capturing economic rent (Fafchamps et al., 2005). Economic rent is the financial compensation above what would be considered normal or above what most butchers would be willing to work for (Lado et al., 1997).

Butchers operating in Funyula earned on average profit margins ranging between -3% and -9% depending on the weight of the pig (Table 5). Funyula is a very rural location with poorly developed market places and high

levels of poverty, likely explaining problems in profitability.

Farmers and consumers usually benefit from lower marketing margins (Staatz et al., 1989) which reflect that a smaller proportion of the retail price is diverted to marketing costs, including butcher profits. The mean marketing margins were 41, 30, 28 and 27% for 22, 30, 35 and 45 kg pigs respectively (Table 5). The mean marketing margin we observed (30%) for pigs at mean market weight of 30 kg (Mutua et al., 2011c) was 9% lower than the reported marketing margin in Nigerian pig markets (Ajala and Adesehinwa, 2008) and nearly half the reported marketing margin of Ugandan cattle markets (Kyeyamwa et al., 2008). Pigs in the Kenyan market chain changed hands only once, and travelled shorter distances than the pigs and cattle in the studies by Ajala and Adesehinwa (2008) and Kyeyamwa et al. (2008). Costs of transport, the number of exchanges, and the transaction costs (partner search, screening, monitoring) associated with increased distance have been reported to contribute to higher marketing margins in SSA (Gabre-Madhin, 2001; Kyeyamwa et al., 2008; Ajala and Adesehinwa, 2007). The lower marketing margins in the Kenyan marketing chain studied may also be attributable to farmers having access to the pork price that is posted in the local butcher shops. The farmers who can estimate pig weights, or who make use of the tape measure and lookup table to estimate their pigs weight (Mutua et al., 2011c) can better assess the value of their pig when they are aware of the posted consumer pork price.

### The determinants of prices, profit and marketing margin

The butcher characteristics and operational practices



**Table 5.** Profit margins and marketing margins for pig purchases of 22, 30, 35, 45 kg by division and education level of butchers operating in Western Kenya, 2008-2009.

Pig weight (kg)	Profit margin (%)				Marketing margin (%)			
	22	30	35	45	22	30	35	45
All	7	5	6	10	41	30	28	27
<b>Division</b>								
Butula	8	8	12	17	41	32	33	34
Funyula	-4	-9	-5	-3	29	16	17	15
Ikolomani	7	1	1	5	41	28	25	24
Shinyalu	9	8	7	9	44	34	29	27
<b>Education Level</b>								
Less than primary	3	1	4	7	40	29	28	26
Completion of primary	2	3	3	6	38	30	26	25
At least some high school	18	12	14	18	45	33	33	33

Source: Data collected (2008 and 2009).

Profit margin = profit per kg / total revenue per kg \* 100

Marketing margin = total revenue – pig price / total revenue \* 100.

outlined in Table 1 that were associated with the outcomes of pork price, pig price, marketing and operating costs, profit, and the marketing margin on a per kg basis are presented in Table 6. The covariance parameter estimates and the between-butcher variability for pig weight and each outcome are presented in Table 7.

### **Pig weight**

Pig weight was associated with the pig price paid to farmers, marketing and operating costs, profit, and marketing margins (Table 6). Butchers paid 10 KES less per kg for pigs in the 22 kg weight class than the referent 45 kg weight category (Table 6). There are a few plausible reasons why butchers pay farmers less for 22 kg pigs. Butchers may realize farmers are desperate to sell a pig when it weighs only 22 kg so they negotiate a lower price. The lower price may be partially justified because slaughter, transport, and inspection costs are charged per pig rather than per kg, effectively increasing the marketing costs of smaller pigs. Another explanation is that butchers are adjusting their prices because of increased transaction costs as more frequent searches and travel result when purchasing smaller pigs more often.

Butcher profits on a per kg basis were highest for pig weight of 22 and 45 kg, of which the weights deviated most from the mean marketing weight of 30 kg (Table 6). The higher profits for 22 kg pigs can be explained from the low pig prices butchers offered, particularly butchers in the high profit group (Table 3). The higher profits for 45 kg pigs was a result of butchers not compensating farmers with higher prices, even though their marketing

costs per kg were considerably lower when purchasing larger pigs (Tables 3 and 6).

### **Education**

Education was associated with pork prices and profit (Table 6). After controlling for division and interview year, butchers with at least some high school education charged a higher pork price and earned higher profits per kg than butchers with no high school education (Table 6). The positive correlation between profit and education is in agreement with the study of Shively et al. (2010). In Kenya, the first two years of high school (forms 1 and 2) mathematics is compulsory and business electives are offered. These courses would provide the mathematical and budgeting skills required for butcher enterprises. The increased knowledge likely makes budgeting easier which increases bargaining power (Shively et al., 2010; Kyeyamwa et al., 2008). Education is a form of human capital and has been found to be a critical factor in marketing decisions (Toure and Wang, 2013).

Further research is required to understand why higher educated butchers are able to charge higher prices for the pork they sell. One explanation is that butchers who are better educated have stronger social networking abilities allowing them to charge higher prices.

### **Location**

Division was associated with pork price, pig price, marketing and operating costs, profits, and marketing margins (Table 6). In the peri-urban district of Kakamega, Shinyalu butchers charged the highest pork prices, paid the highest pig prices to farmers, had the highest

**Table 6.** Factors associated with pork prices charged to consumers, pig prices, marketing and operating costs, profit and marketing margins on a per kg basis for pig butchers operating in Western Kenya, 2008-2009.

	Pork prices <sup>GLM</sup>			Pig prices			Marketing and operating costs			Profit			Marketing margin		
	Pr >F	Estimate	SE	Pr >F	Estimate	SE	Pr >F	Estimate	SE	Pr >F	Estimate	SE	Pr >F	Estimate	SE
<b>Intercept</b>		124.56*	10.5		89.86*	4.36		14.73*	3.45		5.94			21.95*	3.79
<b>Weight (kg)</b>	n/a	n/a	n/a	<0.001			<0.001			0.006			<.001		
-22					-10.79*	2.21		20.8*	.48		-3.14	2.33		13.5**	1.94
-30					-0.40	1.77		10.1*	.47		-5.92*	1.9		2.6	1.62
-35					0.77	1.30		5.8*	.47		-4.34*	1.33		0.8	1.2
-45	.	.	.	.	.	.	.	.	.		.	.	.	.	.
<b>Education Level</b>	0.09									0.011					
-none		-10.21**									-11.44*	5.07			
-primary		-11.77*									-15.54*	5.03			
-high school	.	.	.	.	.	.	.	.	.		.	.			
<b>Division</b>	0.01			<0.001			0.009			0.006			0.01		
-Butula		-10.05*			-20.72*	4.19		-8.1*	2.54		5.08	4.6		8.24**	4.2
-Funyula		-23.19*			-14.66*	5.50		-6.4**	3.46		-14.98*	6.47		-8.1	5.4
-Ikolomani		-14.52*			-0.34	4.96		-0.1	3.44		-13.4**	6.9		-5.36	5.0
-Shinyalu	.	.	.	.	.	.	.	.	.		.	.		.	.
<b>Interview year</b>				0.01											
-2008	<0.001	-19.48*	4.56		-8.63*	3.43									
-2009															
<b>Marketing Type</b>				0.05											
-Raw					-7.83*	3.96									
-Cooked	.	.	.	.	.	.	.	.	.		.	.		.	.
<b>Marketing costs</b>	<0.001	0.036	0.009				n/a	n/a	n/a	n/a	n/a	n/a			
<b>Hours travel</b>										0.03	1.77*	0.78			
<b>Asset index</b>	0.007	62.40*	20.54							0.01	51.33*	20.07			
<b>Asset index <sup>^2</sup></b>	0.002	-40.53*	14.31							0.01	-36.78*	14.23			
<b>Pigs per year</b>							0.004	0.045*	0.001						

Source: Data collected (2008 and 2009).

Referent category; \* is significant t-test at p < 0.05; \*\* is significant t-test at p < 0.10; blank are not significant; n/a not applicable. Mixed models were used for each outcome, using butcher as a random effect, blocking on pig weight to account for dependence between observations, except for the model with the outcome pork price<sup>GLM</sup> which was a GLM model. The Adjusted R-square for the pork price model = 0.53. The covariance and estimate parameters for the mixed models are provided in Table 7.

Profit margin = profit per kg / total revenue per kg \*100

Marketing margin = total revenue – pig price / total revenue \* 100.

**Table 7.** Covariance parameter estimates for butcher (22, 30, 35, and 45 kg) weight and the between-butcher variability accounting for the proportion of variance for every weight for each mixed model outcome (pig price, profit, marketing and operating costs, and marketing margin all on a per kg basis) presented in Table 6 from butcher surveys conducted in Western Kenya (2008-2009).

<b>Covariance parameter estimates and between-butcher variability</b>	<b>Butcher</b>	<b>22 kg</b>	<b>30 kg</b>	<b>35 kg</b>	<b>45 kg</b>
<b>Covariance parameter estimates</b>					
Pig price	91.38	133.48	98.52	28.95	50.25
Marketing and operating costs	40.06	30.03	32	40.69	41.37
Profit	156.76	143.98	111.52	24.01	56.16
Marketing margin	101.77	96.77	76.95	19.95	47.05
<b>Between-butcher variability (%)</b>					
Pig price	n/a	47.8	41.5	13.3	26.3
Marketing and operating costs	n/a	59.3	51.8	24.0	35.4
Profit	n/a	42.8	44.1	50.3	50.8
Marketing margin	n/a	48.7	43.0	16.3	31.6

n/a is not applicable.

marketing and operating costs and earned the 2nd highest profits of any of the butchers. The higher pork prices in Shinyalu were likely attributed to the heavier traffic, larger and more concentrated market centres which were situated close to Kakamega city on route to Kisumu. Butchers in the Ikolomani Division also operating in the Kakamega District charged less for their pork than Shinyalu butchers (Table 6). The difference in pork price caused Ikolomani butchers to earn lower profits by approximately the same proportion (Table 6). Ikolomani butchers paid farmers the same price for pigs as Shinyalu butchers and incurred similar marketing and operating costs (Table 6). Shinyalu and Ikolomani neighbor each other and it is likely that butchers from both divisions purchase pigs from overlapping areas. This likely explains why pig prices paid by butchers in Ikolomani did not differ significantly from the pig prices paid by butchers in Shinyalu (Table 6), even though pork prices differed.

In the more rural Busia District, butchers in Butula charged higher pork prices than butchers in Funyula. The pig prices and marketing and operating costs did not differ significantly from each other. Similarly to butchers in Shinyalu, Butula butchers operated in higher trafficked, more established market locations, charged higher pork prices and in turn made higher profits (Table 6). The butchers in the more remote divisions (Funyula and Ikolomani) within each district had lower profit margins and as a result farmers experienced lower marketing margins.

When comparing divisions, farmers in rural Busia received lower pig prices than farmers in peri-urban Kakamega, which is in agreement with observations in Nigeria where pig prices were higher in urban markets than in rural markets (Ajala and Adesehinwa, 2008). In general, farmers in rural locations experience higher input costs and lower output prices (Chamberlin and Jayne,

2013). In this study, rural farmers were paid lower prices for pigs, and butchers operating in more remote markets earned lower revenues and lower profits.

### ***Pigs purchased per year***

The number of pigs a butcher purchased per year was associated with increase in marketing and operating costs per kg (Table 6). This is likely because butcher enterprises are small and costs of search and travel increase as butchers increase their volumes. The practice of visiting each pig at the farm gate to ensure size and quality prior to purchase limits the number of pig purchases a butcher can make. Butchers hired labour to market pork, but not to negotiate pig prices, making their labour time expensive (Gabre-Madhin, 2001). Bulking purchases could reduce unit costs, but is often not done, as pigs are purchased on a need basis from farms spread over large distances. Smallholder farmers keep few pigs so butchers may seldom find farmers who are willing to sell more than one pig at a time. Butchers are challenged to raise capital in the absence of formal credit (Table 2) and in finding pigs (Levy et al., 2009). They also reported that they often need to sell enough pork in their shop to enable the purchase of a subsequent pig. Traders and retailers in SSA are often limited by financial capital and poor access to credit (Poulton et al., 2006). Lack of refrigeration also limited the number of pigs a butcher could slaughter at a time, limiting the opportunity to economize slaughter and transaction costs.

### **LIMITATIONS AND OTHER CONSIDERATIONS**

In this study, pig purchases were influenced by the researchers' provision of pig weight to butchers. In practice, butchers may be more capable of evaluating

appropriate pig prices by visual inspection. This may have influenced the pig purchase prices butchers provided to the researcher and accounted for some of the variation between butchers.

There are several factors that might impact butcher profits or margins which were not accounted for in this study. The first is the butchers' ability to sell all of the pork before it spoils. It was assumed that all the pork from each pig purchase was sold, which would increase profit. Secondly, a butcher's ability to determine the health of the pig is also important to profitability because pork carcasses that are condemned and pigs that die on the way to slaughter are financial risks borne by the butcher. Thirdly, season will impact profitability and marketing margins as prices are highly volatile in local markets due to fluctuating demand for goods corresponding to harvest seasons (Chamberlin and Jayne, 2013). Further research to understand the impact of season on the pork marketing chain is required. Fourthly, supply and demand factors can also influence profits and marketing margins (Marsh and Brestler, 2004). In this study, we found that location was a determinant for profits and margins, but we did not quantify the differences in the supply of pigs and the demand of pork by location.

Butchers may have had a tendency to exaggerate their costs in this study including the pig prices they pay to farmers, as has been found in previous studies (de Mel et al., 2009). Pig prices may have also been higher because farmers were provided a method of estimating pig weights with tape measures, a year before this study. In this study, butchers provided an average pig price for each weight. On average, these prices were not found to be exploitative. However, farmers still need to be aware of pig weight and the pork price butchers charge in their shops to ensure an equitable exchange.

## Conclusion

This study's aim was to determine the marketing margins of the local pork marketing chain by evaluating cost structures of small-scale pig butcher enterprises, and the factors that impact the participants' pork marketing in rural and peri-urban settings of Western Kenya. The market structure of local pig marketing was mostly competitive and marketing margins were lower than in other livestock marketing chains. Marketing margins tended to decrease with pig weight, so raising the average marketing weight could improve overall marketing efficiency.

Average profit margins were un-exploitative when compared to the cost of acquiring capital. However, profit margins of well educated butchers were higher which indicates that they are likely capturing economic rents, rather than increasing marketing shares and offering the benefit of their efficiencies back to consumers or farmers. More efficient pig butcher enterprises do not capture a

larger market share because the entrepreneur is involved in each exchange, capital is constrained, and supply contracts are non-existent, limiting the volume potential of the micro-enterprise and preventing expansion.

For butchers, location is important for profit. Larger volume markets have higher revenue potential from higher pork prices, translating into higher profitability. Farmers received lower prices per kg for pigs that were below the mean market weight of 30 kg. For larger pigs, farmers did not receive any of the savings in marketing costs butchers experienced.

Institutions which facilitate financial exchange, promote accessible use of weight scales for trade, and provide transparent market information could be beneficial to local marketing of pigs to ensure trade margins are moderate regardless of the animal weight or the negotiation skills of the farmer. Farmer groups have had success in ensuring equitable trades for farmers while lowering transaction costs for marketing agents in SSA (Shiferaw et al., 2011; Fischer and Qaim, 2012).

## ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the pig butchers who participated in the interview process, government meat inspectors, pig farmers, and village elders who enumerated the butchers. They are grateful to Veterinarians without Borders, Canada and the University of Guelph who contributed to the funding of the research. Furthermore, they are grateful to the Veterinary Director General of The Government of Kenya for enabling the research, and William Sears for statistical guidance.

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