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Marketing efficiency analysis of beef cattle markets: A case study from the Republic of Benin

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ABSTRACT

This research aimed to assess the efficiency of beef cattle markets in the Republic of Benin. Primary data were collected from face-to-face surveys of a random sample of 600 respondents consisting of 300 beef cattle farmers and 300 beef cattle traders participating in self-managed beef cattle markets (MBA) and traditional beef cattle markets (MT). Different marketing channels were identified in the selected beef cattle markets: Channel I, Farmer-Slaughterhouse/Butchery; Channel II, Farmer-Collector-Wholesaler-Slaughterhouse/Butchery; Channel III, Farmer-Collector-Slaughterhouse/Butchery; and Channel IV, Farmer-Wholesaler-Slaughterhouse/Butchery. Channel I appears to be the most efficient in both markets with a marketing efficiency of 2.57 in MBA markets and 1.23 in MT markets. The average marketing efficiencies are 1.25 and 0.97 in MBA and MT markets, respectively. The marketing efficiency analysis showed that MBA markets are more efficient than MT markets. To increase the marketing efficiency of farmers, MT markets should be converted into MBA markets. Facilitating transportation and access to market information are critical factors for increasing farmers' marketing efficiency.

1. Introduction

The livestock sub-sector occupies an important place in the economy of Benin. Its contribution to GDP is 5.82%, and its share in the Gross Agricultural Production value is 15.55% (FAO and ECOWAS 2016). Particularly the *Peulh* socio-ethnic groups whose main activity is livestock farming traditionally practice livestock farming in both sedentary and nomadic forms. The nomadic livestock system is implemented in many West African countries, and, despite its extensive and low-productive nature, it plays several roles in pastoral regions, which include securing, capitalization, diversification, economic integration, and social integration (Sounon et al. 2019). Livestock represents major marketable assets held by most rural people, and it is also a voracious form of capital (Turner and Williams 2002).

As institutions that facilitate the conversion of livestock into cash, livestock markets play an economic role in Africa (Turner and Williams 2002). Livestock markets vary significantly in their importance and their attractiveness for livestock traders and farmers (Turner and Williams 2002), but in recent years, they have become centres of interest for decision-makers and important pillars of rural development (Onibon 2004). Many African municipalities owe their economic development to livestock markets (SNV 2016). Given the economic role that livestock markets play in rural areas and their contribution to rural development, it is important to conduct scientific investigations to ensure their sustainable development.

Improving livestock marketing systems requires knowledge of their efficiency and how they function. Marketing efficiency provides information on the performance of the marketing system (Kohls and Uhl 1985). Assessing the efficiency of livestock markets will both help identify the most efficient markets to advise stakeholders in and also identify the least efficient to be improved.

This study aimed to assess the efficiency of beef cattle markets in the Republic of Benin. This research is important because it provides information on beef cattle marketing channels, marketing costs, the farmer's share in the marketing channels, marketing margins, and the marketing efficiency of beef cattle markets in the area studied. This information will help not only the beef cattle market stakeholders to make rational decisions but also national and international institutions to invest in the beef cattle market to improve the marketing system in the Republic of Benin.

To conduct this research, two types of beef cattle markets were studied in the Republic of Benin, traditional markets (MT) and self-managed markets (MBA). Most of the transactions in these markets are for live beef cattle. MT and MBA markets are the two main types of beef cattle markets in the Republic of Benin (Hadj and Aboubakar 2007). In order to reach the goal of this study, the following hypothesis was formulated:

H: Farmers' marketing efficiency is higher in MBA than in MT markets.

MBA markets offer farmers the opportunity to be in direct contact with buyers. This shortens the marketing channel and

reduces transaction costs while in the MT, the farmers are more at the mercy of the traders and intermediaries, which creates a long marketing channel and increases transaction costs. The difference in transaction costs between the two types of beef cattle markets explains the difference in their marketing efficiency. Farmers in the MBA markets have a higher transaction efficiency than those in the MT because they incur comparatively fewer costs in transactions and also sell their animals at better prices. The difference in marketing costs and prices could make the farmers' marketing efficiency higher in MBA markets than in MT markets.

2. Materials and Methods

2.1. Sampling and data collection

A two-stage sampling procedure was used to draw the sample respondents. In the first stage, potential beef cattle markets were identified in six municipalities: Gogounou, Nikki, Bassila, Matéri, Savè, and Iwoyé (Kétou), with the help of the head of the Ministry of Agriculture Department. In the second stage, from the beef cattle markets identified, a face-to-face survey was conducted using a structured questionnaire with a random sample of 600 respondents consisting of 300 (150 in MBA and 150 in MT) beef cattle farmers and 300 (150 in MBA and 150 in MT) beef cattle traders. The data was collected in 2017 and considered the last 12 months of production.

In these markets, beef cattle are sold live without being weighed. The prices are fixed by "eye-ball" pricing on a per-head basis and agreements between seller and buyer. This negotiation pricing system is common to many beef cattle markets in African countries (Kocho et al. 2011; Pratama and Supranianondo 2017; Abdullahi et al. 2018). Marketing margins and costs were calculated per head of live animal (Adefemi 2014; Pratama and Supranianondo 2017; Sikamwaya and Guiyu 2020; Lusk et al. 2021; Yusuf et al. 2021). The local currency in the Republic of Benin is the CFA franc, but the currency used in this document is the American dollar ($ US). The data of the World Bank were used in the conversion of the domestic currency to the US dollar (World Bank 2021).

2.2. Measuring marketing efficiency

In general, marketing efficiency refers to the ratio of input and output, and an increase in this ratio represents improved efficiency and vice versa (Kohls and Uhl 1985; Adanacıoğlu 2014). Many methods have been used to measure marketing efficiency; one common method is to examine marketing margins (Rupindo 2009). The profit-to-cost ratio has also been used to determine the efficiency of a marketing system by comparing the marketing benefits gained to marketing costs incurred by the marketing agency (Adefemi 2014). In this context, the market is efficient if the ratio is positive and equally distributed across all marketing institutions. Another method used to determine marketing efficiency is Acharya's modified method andGangwar et al. (2010) used this method to determine the marketing efficiency of broilers in Delhi in India. Adanacıoğlu (2014) also used the same method to determine the efficiency of direct and indirect marketing channels used by farmers of İzmir in Türkiye. Meshack (2015) estimated the marketing efficiency of the beef cattle value chain in the Longido and Monduli districts in Tanzania with Acharya's modified method. Erdoğan et al. (2016) identified the marketing efficiency of apple production in the Senirkent district of the Isparta province in Türkiye using the same method.

Acharya's modified marketing efficiency formula was also used in this study to determine the marketing efficiency of the beef cattle marketing channels in MBA and MT markets in the Republic of Benin. Acharya's modified marketing efficiency formula is used as follows:

MME = NPF / (MC + NMM) (Gangwar et al. 2007; Dastagiri et al. 2012; Adanacıoğlu 2014; Erdoğan et al. 2016).

Where, MME equals modified marketing efficiency, NPF equals net price received by farmers, NPF equals the gross price received by farmers – farmers' marketing cost, MC equals the total marketing cost incurred by farmers and intermediaries, and NMM equals the total net marketing margin earned by the intermediaries.

The marketing cost was calculated by summing up the different costs engaged during the marketing process by a market participant. The marketing margin was calculated by subtracting the sum of the purchase price and the marketing cost from the selling price per head of live animal by a market participant.

Longwe et al. (2010) states that the marketing effectiveness index coefficient should be greater than 1. The larger this coefficient is than 1, the higher the efficiency in the marketing channel. If this coefficient is less than 1 then this indicates that the marketing channel used was not effective.

3. Results and Discussion

3.1. Animal numbers in Benin

In Benin, cattle, sheep and goat assets have gradually increased over the last 17 years. In 2016, the cattle herd increased by 51.82% with 2339 thousand heads, the sheep herd increased by 37.11% with 915 thousand heads and the goat herd increased by 48.04% with 1836 thousand heads. It appears that the number of cattle has experienced more growth than that of sheep and goats. This can be explained by the spread of MBAs in the country, the sedentarisation of some pastoralists and new livestock entrepreneurs (Table 1). Despite the large number of animals, there is unsatisfied demand for meat in general.

In 2016, cattle meat production increased by 53.11% with a total production of 40 thousand metric tons, sheep meat production increased by 36.21% with a total production of 9 thousand metric tons and goat meat production increased by 48.04% with a total production of 9151 metric tons. Cattle and goat meat cover a large portion of the red meat production (Table 2).

3.2. Beef cattle marketing channels used by farmers

Table 3 shows that almost half of the farmers (148) sold directly to butchers (Channel I) while the others sold to butchers through collectors and wholesalers. Channel I is the most widely used while Channel II is the least used by producers. 49.3% of producers use Channel I while 10% use Channel II.

3.3. Marketing costs and margins in alternative beef cattle marketing channels

Table 4 and Table 5 show the marketing costs per head of beef cattle in MBA and MT markets. In MBA markets, the total marketing costs for each channel were 48.90 $ per head, 66.46 $ per head, 65.08 $ per head, and 58.73 $ per head, for Channel I, Channel II, Channel III, and Channel IV respectively. The average marketing cost in the MBA markets was 59.79 $ per head.

Table 1. The herd of large and small ruminants in Benin (1000 Heads)

Years	Cattle	Index (2000= 100)	Sheep	Index (2000= 100)	Goat	Index (2000= 100)
2000	1541	100.00	667	100.00	1240	100.00
2001	1599	103.76	679	101.76	1266	102.10
2002	1639	106.40	683	102.39	1320	106.40
2003	1676	108.79	690	103.40	1306	105.30
2004	1718	111.51	708	106.09	1346	108.53
2005	1718	111.51	724	108.49	1386	111.75
2006	1810	117.48	742	111.19	1427	115.06
2007	1857	120.53	762	114.23	1454	117.21
2008	1905	123.65	781	116.99	1483	119.60
2009	1954	126.83	791	118.53	1570	126.59
2010	2005	130.14	808	121.08	1605	129.41
2011	2058	133.58	825	123.63	1640	132.23
2012	2111	137.02	842	126.17	1678	135.30
2013	2166	140.59	860	128.87	1716	138.36
2014	2222	144.23	878	131.57	1755	141.51
2015	2280	147.99	896	134.27	1795	144.73
2016	2339	151.82	915	137.11	1836	148.04

Source: FAOSTAT, 2022, FAOSTAT Database, www.fao.org/faostat.

Table 2. Red meat production in Benin (Metric Ton)

Year	Cattle (MT)	Index (2000= 100)	Sheep (MT)	Index (2000= 100)	Goat (MT)	Index (2000= 100)
2000	26126	100.00	6607	100.00	6182	100.00
2001	27108	103.76	6724	101.76	6311	102.10
2002	27797	106.40	6765	102.39	6578	106.40
2003	28421	108.79	6832	103.40	6510	105.30
2004	29131	111.51	7010	106.09	6709	108.53
2005	29131	111.51	7168	108.49	6908	111.75
2006	30693	117.48	7347	111.19	7113	115.06
2007	31490	120.53	7548	114.23	7246	117.21
2008	32304	123.65	7730	116.99	7393	119.60
2009	33135	126.83	7832	118.53	7826	126.59
2010	34000	130.14	8000	121.08	8000	129.41
2011	35000	133.97	8000	121.08	8174	132.23
2012	36000	137.80	9000	136.21	8364	135.30
2013	37000	141.62	9000	136.21	8553	138.36
2014	38000	145.45	9000	136.21	8748	141.51
2015	39000	149.28	9000	136.21	8947	144.73
2016	40000	153.11	9000	136.21	9151	148.04

Source: FAOSTAT, 2022, FAOSTAT Database, www.fao.org/faostat.

Table 3. Beef cattle marketing channels used by the farmers studied

Marketing Channels	Frequency	Percentage
Channel I: Farmer- Slaughterhouse / Butchery	148	49.30
Channel II: Farmer -Collector-Wholesaler- Slaughterhouse / Butchery	30	10.00
Channel III: Farmer -Collector- Slaughterhouse / Butchery	59	19.70
Channel IV: Farmer -Wholesaler- Slaughterhouse / Butchery	63	21.00
Total	300	100.00

Table 4. Marketing costs in MBA ($/head)

Marketing costs	Channel I	Channel II	Channel III	Channel IV	Mean
Transportation	17.64	17.64	17.64	18.94	17.97
Loading and unloading	4.73	4.73	4.73	5.17	4.84
Veterinary control	2.58	2.58	2.58	2.58	2.58
Taxes	4.13	6.03	5.17	5.34	5.17
Commissions	0.00	8.78	8.44	9.82	6.76
Ropes	6.03	7.75	7.75	6.89	7.10
Feed	13.78	18.94	18.77	9.99	15.37
Total marketing cost	48.90	66.46	65.08	58.73	59.79

Table 5. Marketing costs in MT ($/head)

Marketing costs	Channel I	Channel II	Channel III	Channel IV	Mean
Transportation	28.07	28.07	28.07	28.07	28.07
Loading and unloading	4.31	4.31	4.31	4.31	4.31
Veterinary control	2.58	2.58	2.58	2.58	2.58
Taxes	10.16	10.51	10.85	13.61	11.28
Commissions	0.00	26.69	16.36	4.31	11.84
Ropes	12.74	14.64	12.92	10.33	12.66
Feed	11.02	17.05	17.05	11.88	14.25
Total marketing cost	68.89	103.85	92.14	75.09	85.00

In MT markets, the total marketing costs for each channel were 68.89 $ per head, 103.85 $ per head, 92.14 $ per head, and 75.09 $ per head, for Channel I, Channel II, Channel III, and Channel IV respectively. The average marketing cost in the MT market was 85.00 $ per head.

In both markets, Channel I had the lowest cost and Channel II, which was the longest, had the highest cost. Among the costs, transportation was the highest for each channel in both markets. This is due to the poor road infrastructure and inadequate means of transportation (Ajala and Adesehinwa 2007). The average marketing costs in the MT market was higher than in the MBA market. The difference in marketing costs was due to poor marketing infrastructure, lack of market information, poor road conditions and exorbitant transportation costs, lack of good organization, and lack of standardization and classification, especially in MT markets (Ajala and Adesehinwa 2007).

Table 6 and Table 7 show marketing margins and the farmer's share of the beef cattle marketing channels. The farmer's share is the percentage of the price received by the farmer compared to the selling price of the retailer. In both markets, Channel I has the highest farmer's share (77.68% for MBA, 63.14% for MT) and Channel II the lowest farmer's share (50.00% for MBA, 57.71% for MT). The average farmer's share was 61.86% and 59.64% in the MBA and MT beef cattle markets, respectively. The larger the farmer's share, the more efficient the marketing (Pratama and Supranianondo 2017; Zhu et al. 2019).

The average marketing margins were 314.05 $ per head and 265.88 $ per head in the MBA and MT beef cattle markets, respectively. The difference in marketing margins in both markets is due to the difference between the selling and buying prices and the transaction costs incurred by farmers in each market.

The costs incurred in the transaction of animals by farmers in MBA were less than in MT markets. This is due to the reduction of some costs in MBA including commission fees, corruption charges in the markets, etc.

The difference observed in the selling and buying prices in both markets is due to the price fixing mechanism in each market. In MT markets, farmers have little involvement in price formation whereas in MBA markets, the seller and buyer determine the price together. Onibon (2004) stated that the selling price of an animal in the MBA market is about 25% higher than the selling price of the same animal when sold in the MT market.

3.4. Marketing efficiency of the beef cattle trade in MBA and MT markets

Table 8 and Table 9 show the marketing efficiency for the beef cattle trade. In both markets, Channel I had the highest marketing efficiency (2.57 for MBA, 1.23 for MT) and Channel II had the lowest marketing efficiency (0.80 for MBA, 0.81 for MT). The average marketing efficiency found for MBA was 1.25 and for MT was 0.97. This showed that, for the beef cattle trade, MBA beef cattle markets were more efficient than MT ones.

In the MBA and MT markets, there are two marketing channels with a marketing efficiency ratio greater than 1. One of these marketing channels is Channel I (farmer–slaughterhouse/butcher) where there are very few intermediaries. The farmer sells directly to the slaughterhouse or butcher. The second marketing channel is Channel IV (farmer–wholesaler–slaughterhouse/butcher). Although Channel IV is not a very short marketing channel, unlike other channels (Channel II and III), it does not include animal collectors who have been identified as a factor in increasing marketing costs and margins. The price difference and marketing costs could explain the difference in marketing efficiency observed in Channel IV and Channels II and III. In order to determine the difference in marketing efficiencies of the marketing channels for beef cattle, it is necessary to know the costs and prices received by the final consumers (Yusuf et al. 2021).

Table 6. Marketing margins and farmers' share in marketing channels in the MBA markets

Particulars	Channel I	Channel II	Channel III	Channel IV	Mean
The price received by the farmers ($/head) (1)	601.99	421.93	444.97	495.99	491.22
The butcher's sale price to the consumer ($/head) (2)	774.98	843.87	792.20	780.15	803.68
Marketing margin ($/head) (2-1)	172.99	421.93	347.23	284.16	314.05
Farmers' share in the consumer price (%) [(1/2) *100]	77.68	50.00	56.17	63.58	61.86

Table 7. Marketing margins and farmers' share in marketing channels in the MT markets

Particulars	Channel I	Channel II	Channel III	Channel IV	Mean
The price received by the farmers ($/head) (1)	378.88	396.88	393.00	395.43	391.05
The butcher's sale price to the consumer ($/head) (2)	600.09	687.67	680.26	659.70	656.93
Marketing margin ($/head) (2-1)	221.21	290.79	287.26	264.27	265.88
Farmers' share in the consumer price (%) [(1/2) *100]	63.14	57.71	57.77	59.94	59.64

Table 8. Marketing efficiency for beef cattle in MBA markets

Particulars	Channel I	Channel II	Channel III	Channel IV	Mean
The price received by the farmers ($/head) (1)	601.99	421.93	444.97	495.99	491.22
Marketing costs incurred by farmers ($/head) (2)	8.61	18.08	18.08	12.06	14.21
Net price received by the farmers ($/head) (1-2)= 3	593.38	403.85	426.88	483.93	477.01
Total Marketing Cost ($/head) (4)	48.90	66.46	65.08	58.73	59.79
The total marketing margin of the market intermediaries ($/head) (5)	181.60	440.02	365.32	296.21	320.79
Marketing Efficiency [3/ (4+5)]	2.57	0.80	0.99	1.36	1.43

Table 9. Marketing efficiency for beef cattle in MT markets

Particulars	Channel I	Channel II	Channel III	Channel IV	Mean
The price received by the farmers ($/head) (1)	378.88	396.88	393.00	395.43	391.05
Marketing costs incurred by farmers ($/head) (2)	9.47	42.54	32.55	18.08	25.66
Net price received by the farmers ($/head) (1-2)= 3	369.41	354.34	360.45	377.35	365.39
Total Marketing Cost ($/head) (4)	68.89	103.85	92.14	75.09	84.99
The total marketing margin of the market intermediaries ($/head) (5)	230.69	333.33	319.81	282.35	291.54
Marketing Efficiency [3/ (4+5)]	1.23	0.81	0.87	1.06	0.99

3.5. General discussion

In most African countries such as Benin, animals are often sold live in livestock markets through different marketing channels involving multiple actors at different levels (Kocho et al. 2011; Abdullahi et al. 2018). In this study, four marketing channels were identified in the beef cattle markets selected. These channels include market participants such as beef cattle farmers, collectors, wholesalers, retailers (slaughterhouse/butcheries). In the beef cattle markets in the area studied, animals are generally traded by "eye-ball" pricing on a per-head basis, and agreements between seller and buyer are reached after negotiations sometimes involving commissioners (brokers) (Kocho et al. 2011; Pratama and Supranianondo 2017; Abdullahi et al. 2018). Animal prices are higher in the MBA markets than in the MT markets (Onibon 2004).

The marketing costs are relatively lower in the MBA market than those in the MT markets (Onibon 2004). Transportation is the highest costs in all channels in both markets due to the poor road infrastructure and the inadequate means of transportation (Dinku et al. 2021). High transportation costs are generally faced by livestock actors in Africa (Meshack 2015; Okeke-Agulu and Ochelle 2019; Sikamwaya and Guiyu 2020). The high marketing costs in the MT markets show their low efficiency. The higher the transaction costs, the more inefficient the market (Meshack 2015; Dinku et al. 2021).

Marketing margin estimates were made on a per head basis (Adefemi 2014; Pratama and Supranianondo 2017; Sikamwaya and Guiyu 2020; Lusk et al. 2021; Yusuf et al. 2021). The marketing margins per head of beef cattle in the MBA beef cattle markets were higher than those in MT beef cattle markets. The farmer's shares in MBA markets were higher than those in MT markets. The larger the farmer's share, the more efficient the marketing system (Pratama and Supranianondo 2017).

Marketing efficiency is the degree of market performance (Giroh et al. 2010). The average marking efficiency in MBA and MT beef cattle markets were 1.25 and 0.97, respectively, for beef cattle trade. Taiye (2018) found 1.00 for marketing efficiency in the beef cattle market of Ibarapa in Nigeria, which implies that the cattle market was efficient. Okeke-Agulu and Ochelle (2019) found 0.89 for beef cattle marketing efficiency in the Jos metropolis in the state of Plateau, Nigeria because marketing costs constitute a very high percentage of sales. The difference in the results may be due to the methodology used to estimate the marketing efficiency, the price difference, or the marketing costs.

4. Conclusion

Based on the results of this research, for beef cattle trade in MBA and MT beef cattle markets, it can be seen that marketing Channel I is the most efficient, showing the lowest value for the marketing margin and the highest value of farmer's share. The results also highlighted the fact that MBA beef cattle markets are more efficient than MT beef cattle markets for beef trade.

To improve the efficiency of beef cattle markets in the studied area, farmers should form groups and associations to improve access to information, increase participation in formal markets (MBA), and reduce transaction costs (Onibon 2004). Promoting MBA markets will reduce intermediaries and make the marketing system efficient because the shorter the channel, the more efficient the trade (Dewi et al. 2021). Local governments should invest in livestock markets and road infrastructure because participation and access to livestock markets are influenced by good road conditions and access to market information.

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