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Comparing the commercialisation margins among traders of the marketing channel of cassava flour in Yaoundé, Cameroon

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ABSTRACT

In Yaoundé (Cameroon), one deplores a lack of transparency of information between trader categories along the marketing channel of cassava flour. This paper investigated that issue by evaluating the marketing margins among trader categories of cassava flour in the Yaoundé urban markets. The results indicated that the yearly average net margins of different trader categories of cassava flour were different in pairs with wholesalers earning the most (435,022 FCFA), followed in order by semi-wholesalers (333,709 FCFA) and retailers (90,566 FCFA). The Lorenz curve coupled with Gini coefficient and Atkinson index indicated evidence of an asymmetry of information by stratum of income for each trader category which was very high among retailers and low among wholesalers and semi-wholesalers. In order to achieve fairness, the cassava flour traders should organise themselves into groups/cooperatives and should be accompanied by government to promote partnership between trader groups and cooperatives and to improve their negotiation skills and marketing information systems.

Keywords: Cassava flour, marketing margins, wholesalers, semi-wholesalers, retailers, Lorenz curve, Gini coefficient, Atkinson index.

INTRODUCTION

According to FAO (2013), the global supply of cassava (*Manihot esculenta*) reached 256 million tons in 2013. In Africa, this is the first root (tuber) produced on a large scale (Enete, 2008; Tolly, 2013; Boli et al., 2023). According to the development strategy of the cassava sub-sector in Cameroon (2010), 80% of the country's population consumes at least one of the products of cassava derivatives (SDFMC, 2010; Boli et al., 2023).

Indeed, with domestic production estimated at 5.03 million tons in 2018 (FAO, 2020), cassava derivatives enter the staple diet of 7 to 8 million of Cameroonian (i.e. one-third of population) with a concentration in eight out of the ten regions of the country, representing a significant share of 8% of daily nutritional intake with 20% of arable land planted and nearly 46% of the national food crop production (Gnonlonfin et al., 2011; Tolly, 2013; PIDMA, 2017). The same sources attest

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that in view of the growing demand in urban centres, the interest of cassava as a commercial crop tends to impose itself. According to Tolly (2013), this is more of a reality as the sub-sector alone covers 60% of the market share of the roots and tubers with 40% for processed products (cassava flour/fufu, gari, chips and water fufu) and 20% for the fresh root.

According to PIDMA (2017), cassava is channelled through a marketing chain made up of six key actors: producers, processors, wholesalers, semi-wholesalers, retailers and consumers. Producers are farmers responsible for cassava production in rural areas. Processors are either farmers themselves or business entities installed in rural areas that transform fresh cassava into processed products such as cassava flour, gari, chips and water fufu. Being a less perishable product, cassava flour is produced in remote areas and marketed by intermediaries. Fidelity based relations between producers and buyers are frequent to face the problems of uncertainty about quality or supply. The wholesalers, most of the time, are producers and processors themselves selling their products to the semi-wholesalers or retailers installed in urban markets (Tricochet et al., 2008; Mutyaba et al., 2016; Ako'o, 2017). The FAO (2020), estimated that an average consumer purchases up to 5.1 kg/year of cassava flour in Cameroon.

However, the revenue from consumption or sales of cassava flour does not benefit all trader categories because the sub-sector deplores a lack of transparency of information by traders along the marketing channel of this product in Cameroon (Tricochet et al., 2008). Tolly (2013), also observed a limited access to information on the situation of rural and urban markets for the different actors who are organised around the sector, especially the traders. Therefore, at every level of the market, there is an asymmetry of information that only benefits to some trader categories, but very little to others who do not take full advantage of their activity (Tricochet et al., 2008; Tolly, 2013). According to FAO (2015), it is a major obstacle which manifests itself through the limit of gains (net margins) of some trader groups who do not take full advantage of their marketing activities (Koffi et al., 2007; FAO, 2015). Because of this, a lack of exogenous economic information on agricultural markets is a hindrance to improving the bargaining power and the equitable distribution of revenue between the three main trader categories (wholesalers, semi-wholesalers and retailers) in the marketing chain of cassava flour (Koffi et al., 2007; Tricochet et al., 2008).

In order to compensate for the lack of exogenous economic information on agricultural markets and improve the productivity, competitiveness, quality and access to markets for different trader categories, it is important to contribute to the efforts made by everyone, to investigate the distribution of the marketing margins of cassava products in urban markets (PIDMA, 2017; World Bank, 2019). Cassava flour being the most commercialised product derived from cassava in Cameroon (Tricochet et al., 2008; Gnonlonfin et al., 2011), it would be necessary to inquire on its distribution and fairness of the marketing of this product as well as on the margins between the different trader categories at the level of urban markets.

Thus, in the development perspective of agricultural markets, this research makes a contribution to the creation of an information system focused on the commercialisation of cassava flour in the urban markets of Yaoundé. For a better transparency of the markets, the study focuses on prices and services open to all actors involved in the trade including activities grafted to commercialisation of cassava flour. Hence, the overall objective of the study was to compare the marketing margins of cassava flour for the different trader categories and to analyse the equity inside and between the different trader categories.

MATERIALS AND METHODS

Study area and data collection

The study used both primary and secondary data. The primary data were collected during a field survey conducted from March to June 2022 in Yaoundé, Cameroon. Benefiting from its strategic geographical

location and proximity to the neighbouring countries of the CEMAC zone, Yaoundé was chosen for this study because: (i) it is the main city of cassava supply and marketing in the Central African zone (Jaza, 2015; Ako'o, 2017); (ii) it is the capital city of Cameroon hosting the Ministry of Agriculture with its agricultural development projects in charge of supervising the cassava flour marketing in the country (Jaza et al., 2020); (iii) it is situated at the Centre region of the country with favourable weather conditions which enable the cultivation of cassava; (iv) it is the city of supply and the dispatching commercial point of several cassava markets (Tricochet et al., 2008; Jaza et al., 2020); (v) it has a population of about 4 million inhabitants, mainly consumers of cassava flour (about 5.1 kg/person/year) and other sub-products derived from cassava (SDSR, 2011; FAO, 2020; Jaza et al., 2020; SDFMC, 2020), (vi) in each of its seven sub-divisions, the city hosts several markets (about 50) specialised in the sales of cassava flour and sub-products (Jaza, 2015; PIDMA, 2017).

As Yaoundé counts seven sub-divisions and based on literature review (Ongla and Davis, 1979; Tricochet et al., 2008; Nakuna, 2010; Jaza, 2015; Ako'o, 2017; Jaza et al., 2020), the height of marketing activities and the volume of trader concentrations in different markets were used to purposively select the markets surveyed in the area. On that basis, nine specialised markets of cassava flour were adopted by sub-division as follows: (i) Elig-Edzoa, Etoudi and Mfoundi markets in Yaoundé I sub-division; (ii) Mokolo market in Yaoundé II sub-division; (iii) Nsam-Efoulan market in Yaoundé III sub-division; (iv) Ekounou and Mvog-Mbi markets in Yaoundé IV sub-division; (v) Essos market in Yaoundé V sub-division; (vi) Acacia market in Yaoundé VI sub-division; and (vii) Nkolbisson market in Yaoundé VII sub-division (Table A4).

The sample selection during the field survey was conducted in accordance with population representativeness of traders in each category and by purposively choosing traders with at least five years of professional experience in the marketing of cassava flour at any of the selected markets. Table A4 presents the number of selected traders per category in function of the localisation of markets within the different sub-divisions of the Yaoundé urban council. In total, 515 cassava flour traders made up of 144 wholesalers, 151 semi-wholesalers and 220 retailers were selected in this study.

The survey served to collect relevant data from each trader category such as the gross margin, selling price, quantity sold, purchasing price and quantity of cassava flour. These primary data were supplemented by secondary data from academic and technical project publications on the cassava marketing sub-sector in Cameroon, such as the transport cost (loading, unloading), tax, functioning charges (water, electricity, maintenance), packaging cost, etc.

Data analysis

To achieve its objectives, this study computed the gross, unit and net margins of different trader categories (wholesalers, semi-wholesalers and retailers) of cassava flour. These calculations were further supplemented with the equity analysis (Lorenz curve, Gini coefficient and Atkinson index computations) by using Excel. Furthermore, by using the SPSS software programme, an ANOVA (Analysis of Variance) was undertaken to compare the net margins among the three trader categories.

Mathematical expressions of different marketing margins

Gross margin

Gross margin (GM) was defined as the difference between the revenue (selling price *times* selling quantity) and the cost of purchase (purchasing price *times* purchasing quantity) of cassava flour (Honfoga, 2014; Mankiw, 2018). For each trader category (wholesalers, semi-wholesalers and retailers), it was estimated by using the following mathematical formulation (Mankiw, 2018):

$$GM = (SP \times SQ) - (PP \times PQ) \quad (1)$$

Where GM: Gross margin; SP: Selling price; SQ: Selling quantity; PP: Purchasing price; PQ: Purchasing quantity of cassava flour.

Unit gross margin

The unit gross margin (UGM) was the difference between the selling price and purchasing price of cassava flour for each trader category expressed as follows (Mankiw, 2018):

$$UGM = SP - PP \quad (2)$$

Where UGM: Unit gross margin; SP: Selling price; PP: Purchasing price of cassava flour.

Net margin

The net margin (NM) was the difference between the gross margin and total cost of expenses of each trader category in the cassava flour market formulated as follows (Mankiw, 2018):

$$NM = GM - TC \quad (3)$$

Where NM: Net margin; GM: Gross margin; TC: Total cost of marketing expenses of cassava flour.

In Equation 3, the elements of total costs i.e. marketing costs estimated for each trader category were the transport cost (including loading and/or unloading), tax, operating costs of the warehouse (electricity, water, maintenance, etc) and packaging cost of cassava flour.

Unit net margin

The unit net margin (UNM) was the unitary profit realised by the trader. It corresponded to the difference between the unitary gross margin and the unitary marketing cost (Mankiw, 2018). From Equation 2, the UNM for each trader category in the cassava flour market was estimated as follows (Mankiw, 2018):

$$UNM = UGM - UMC = SP - PP - UMC \quad (4)$$

Where UNM: Unit net margin; UGM: Unit gross margin; UMC: Unitary marketing cost; SP: Selling price; PP: Purchasing price of cassava flour.

As decision rule from Equations 1 to 4, the cassava flour marketing activity would be profitable to any trader category if the computed margin (gross, unit, net) was positive. A null or negative result implied a zero or non-profitability of the activity for any trader category (Mankiw, 2018).

Lorenz curve

This study used the Lorenz curve in order to measure the degree of inequality of income earned among the trader categories i.e. the proportion of total income measured in terms of relative net margin (RNM) detained by a given percentage of trader category (Lorenz, 1905; FAO, 2006; Mankiw, 2018). For this purpose, the Lorenz curve was constructed by showing on the y-axis the cumulative share of RNM of each trader category; and on the x-axis the cumulative proportion of the sampled population of each trader category (FAO, 2006; Mankiw, 2018).

From the theory, it is important to highlight that the further away Lorenz curve lies from the equality line, the stronger the inequality observed at the level of the distribution of the net marketing margins for each trader category (Lorenz, 1905; Mankiw, 2018). By analogy for this study, the more this curve was closer to the equality line, the more inequities were lower at the level of the distribution of the net marketing margins for the same category of traders (FAO, 2006; Mankiw, 2018)). However, as the graphical illustration of Lorenz curve is often incomplete to represent the income inequality in a population, it is usually supplemented with a Gini coefficient which gives a numerical value to this illustration (Gichangi, 2012; Mankiw, 2018).

Gini coefficient

The mathematical equation for computing the Gini coefficient was expressed as follows (FAO, 2006; Mankiw, 2018):

$$G = \left[cov[y, F(y)]\right] \times \frac{2}{\bar{y}} \quad (5)$$

Where G: Gini coefficient; y: Distribution of net margins; F(y): Cumulative distribution of net margins; $\bar{y}$: Average net margins of the identified trader categories; cov: Co-variance.

As a decision rule (Equation 5), the more the Gini coefficient approached 1, the more inequality of the net margin distribution existed between the individuals of any trader category. Generally, from the economics' literature, a Gini coefficient ranging between 0.20 to 0.35 indicates an equal distribution of

the net margins between the individuals of any trader category and a zero value shows a perfect equality (FAO, 2006; Gichangi, 2012; Mankiw, 2018).

Although the Gini coefficient allows direct comparison of the income distribution of two populations, regardless of their sizes, its main limitation is that it is not easily decomposable or additive (FAO, 2006; Gichangi, 2012; Mankiw, 2018). Also, it does not respond in the same way to income transfers between people in opposite tails of the income distribution as it does to transfers in the middle of the distribution (Gichangi, 2012; Abdelateif and Omima, 2015). Furthermore, very different income distributions can present the same Gini coefficient. Such weaknesses were overcome in this study by supplementing the Gini coefficient with the Atkinson index (FAO, 2006; Abdelateif and Omima, 2015; Mankiw, 2018).

Atkinson index

This is the most popular welfare-based measure of inequality (FAO, 2007). It presents the percentage of total income that a given society would have to forego in order to have more equal shares of income between its citizens. An important feature of the Atkinson index is that it can be decomposed into within and between-group inequality. Moreover, unlike other indices, it can provide welfare implications of alternative policies and allows the researcher to include some normative content to the analysis (Bellù and Liberati, 2006).

In this study, the Atkinson index (A_ε) for each trader category of cassava flour was mathematically formulated as follows (Atkinson, 1970; FAO, 2007; Mankiw, 2018):

$$A_\varepsilon = 1 - \left[\frac{1}{n}\sum_{i=1}^{n}\left[\frac{y_i}{\bar{y}}\right]^{1-\varepsilon}\right]^{1/1-\varepsilon} \quad (6)$$

Where y_i: Net margin of the i^{th} trader in the category; n: Total number of traders (sample size) in the category; $\bar{y}$ =Average net margin from all traders in the category; ε: Aversion parameter of inequality usually specified by the researcher ($3 \leq \varepsilon \leq 21$, in this study).

It is worth noting that by increasing the aversion parameter of inequality (ε), the value of the Atkinson index (A_ε) would also increase and the society would become more concerned about inequality (Atkinson, 1970). In other terms, the higher the ε value, the more sensitive the Atkinson index would become to inequalities at the bottom of the income distribution. It means that the society would be prepared to give up increasing shares of total income in order to achieve equality in incomes. Generally, the Atkinson class of measures range from 0 to 1, with zero representing no inequality. A higher Atkinson index value entails greater social utility or willingness by individuals to accept smaller incomes in exchange for a more equal distribution (FAO, 2007).

RESULTS

Cassava flour margins

Table 1 presents the field survey results on the yearly quantity of cassava flour purchased and sold per trader category. On average, a wholesaler resold 216 out of 218 purchased bags of 50 kg of cassava flour. A semi-wholesaler resold 120 out of 122 purchased bags of cassava flour whereas a retailer resold 35 out of 36 purchased bags of cassava flour.

The average purchasing prices were 14,705; 13,892 and 14,995 FCFA per bag of cassava flour for the wholesalers, semi-wholesalers and retailers, respectively. The purchased cassava flour was resold at higher price of 17,864; 18,103; and 19,363 FCFA per bag for the wholesalers, semi-wholesalers and retailers, respectively so as to enable each of the trader categories to earn additional income (Table 1). Hence, the unit gross margin (selling price *minus* purchasing price) was estimated at 3,159; 4,211 and 4,368 FCFA and the yearly gross margin was 652,934; 482,762 and 138,680 FCFA for the wholesalers, semi-wholesalers and retailers, respectively (Table 1).

By comparing the marketing charges (transport, maintenance, tax, rent, storage, etc) among different trader categories, the retailers recorded the lowest amount of expenses (48,114 FCFA), followed in order by semi-wholesalers (149,052 FCFA) and wholesalers (217,912 FCFA) (Table 1).

By subtracting these marketing charges to the previous calculations, the yearly gross margins were considerably reduced to yearly net margins of 435,022; 333,709; 90,566 FCFA

for the wholesalers, semi-wholesalers and retailers, respectively (Table 1). The unit gross margins were also reduced to unit net margins of 2133; 2878; and 2165 FCFA per bag of 50 kg, for the wholesalers, semi-wholesalers and retailers, respectively (Table 1).

Among the computed results in Table 1, the net margin (NM) was used for the rest of analysis in this study because it is the main indicator of profitability of the marketing activities of cassava flour in the city of Yaoundé (Honfoga, 2014; Ako'o, 2017). Given that the marketing function is independent at the level of the amount bought and sold by each trader category, it was important to compare the net margins of different actors in order to gauge the market performance at the level of each trader category.

Table 2 shows the results of descriptive statistics (minimum, maximum, mean and standard deviation) of the net margin computed for each trader category. Although each trader category recorded on average a positive net margin, one however observed negative minimum figures in some cases, testifying that this activity was not gainful to everyone. A one-way ANOVA test (Table 2) confirmed that, the average net margins of the different actors involved in the trade of cassava flour in the Yaoundé-city were different in pairs (two trader categories taken at a time) (F=15,315; P=0.000). The difference in average net margin between the different trader categories of cassava flour in the city of Yaoundé was dependent on many factors determined by the mechanism of supply and demand of the quantities at the level of supply areas that define markets in rural areas.

Equity analysis

This section presents the results of equity analysis by using the Lorenz curve, Gini coefficient and Atkinson index for each trader category of cassava flour in the city of Yaoundé.

Lorenz curve

Figure 1 shows that the Lorenz curve of each trader category was below the RNM equality line. There exists, therefore, in this case, a relative dominance of Lorenz curve (FAO, 2006; Mankiw, 2018). It illustrates at the level of Figure 1 that in terms of ranking, the wholesalers Lorenz curve was more egalitarian than the semi-wholesalers and retailers; and the Lorenz curve of the semi-wholesalers was still more egalitarian than that of retailers.

According to Figure 1, the wholesalers Lorenz curve tended to be closer to the curve of Relative Net Margin (RNM) equal distribution line than to the semi-wholesalers and retailers Lorenz curves; and seemed farthest from the x-axis. Thus, it was close to the egalitarian situation. There was then less inequality in the distribution of the RNM between wholesalers of cassava flour in the city of Yaoundé. Table A1 was associated with the observations of the wholesalers Lorenz curve of Figure 1 (blue colour). It analysed data arising from the wholesalers Lorenz curve at the main observation points (X, A, D, F, H, J).

In Figure 1, the semi-wholesalers Lorenz curve seemed closer to that of the wholesalers; farthest at its base and closest to the top of the curve of equi-distribution of the relative net margin (RNM). Also, it seemed closest to its base and further away at the top of the x-axis. It must be concluded that there was more or less inequality in the distribution of the RNM between semi-wholesalers of cassava flour in the city of Yaoundé.

In Figure 1, the Lorenz curve of retailers was furthest away from that of semi-wholesalers and wholesalers. That is, it was still further away from the curve of equi-distribution of the Relative Net Margin (RNM).

Gini coefficient

Table 3 presents the Gini coefficient computed for each trader category along the marketing channel of cassava flour in Yaoundé. From the results, it could be observed that monetary inequalities related to the distribution of the Relative Net Margin (RNM) increased from one trader category to another. More precisely, the Gini coefficient of wholesalers (0.340) was lower than that of semi-wholesalers (0.394) which was also inferior to the Gini coefficient of retailers (0.753). However, as shown in Table 3 (first row), the aggregate Gini coefficient for all

trader categories was 0.441, i.e ranged between that of (semi)-wholesalers and retailers.

Atkinson index

In this study, the Atkinson index was used to calculate the proportion of social welfare that would be required if net margins were to be perfectly distributed within each trader category. Its results presented in Table 4 indicated that if the aversion parameter of inequality (ε) rose from 3 to 21, the Atkinson index for the distribution of net margin would increase from 0.365 to 0.811 for wholesalers; from 0.619 to 0.879 for semi-wholesalers; from 0.703 to 0.871 for retailers; and from 0.807 to 0.959 for all trader categories (Table 4). If for instance ε was equal to 3, the Atkinson index would be 0.365, 0.619, 0.703 and 0.807 respectively for the wholesalers, semi-wholesalers, retailers and all trader categories. This implied that the wholesalers, semi-wholesalers, retailers and all trader categories would be ready to give up respectively 36.5%, 61.9%, 70.3% and 80.7% of their net margin to have equally distributed net margins in the study area. The results were similarly interpreted for other levels of inequality aversion (ε). These results also suggested that, for the same levels of inequality aversion (ε), there was a significant difference of Atkinson index values between the three trader categories of cassava flour in the study area (Table 4).

Table 1: Cassava flour's operating account showing the yearly purchasing and selling prices and quantities, marketing charges and margins by trader categories.

		Units	Categories of traders		
			Wholesalers (N=144)	**Semi-wholesalers (N=151)**	**Retailers (N=220)**
Purchasing activity from suppliers	Average quantity of annual purchase (PQ)	bag of 50 kg	218	122	36
	Average purchasing price (PP)	FCFA per bag of 50 kg	14,705	13,892	14,995
Selling activity within the Yaoundé-city	Average quantity of annual sales (SQ)	bag of 50 kg	216	120	35
	Average selling price (SP)	FCFA per bag of 50 kg	17,864	18,103	19,363
Marketing charges* (transport, maintenance, tax, rent, storage, etc.)	Total marketing cost (TC)	FCFA	217,913	149,053	48,114
	Unitary marketing cost (UTC)	FCFA per bag of 50 kg	1026	1333	2203
Marketing margin by trader categories*	Gross margin (GM)	FCFA	652,934	482,762	138,680
	Unit gross margin (UGM)	FCFA per bag of 50 kg	3159	4211	4368
	Net margin (NM)	FCFA	435,022	333,709	90,566
	Unit net margin (UNM)	FCFA per bag of 50 kg	2133	2878	2165

Notes: *Computed according to Equations 1 to 4; 1 Euro=656 FCFA; 1USD=600 FCFA.

Table 2: Descriptive statistics of the net margin (in FCFA/year) recorded by trader categories.

Trader categories	Minimum	Maximum	Mean	Standard deviation
Wholesalers (N=144)	-365,850	1,258,100	435,022	280,253
Semi-wholesalers (N=151)	-413,100	827,800	333,709	218,728
Retailers (N=220)	-92,950	400,950	90,566	114,794
TOTAL	//	//	Mean difference (ANOVA): Sig.=0.000 F=15,315	//

Note: 1 Euro=656 FCFA; 1USD=600 FCFA.

Table A1: Analysis of observations at different points of the wholesalers Lorenz curve.

Observation point	Cumulation of the population of wholesalers (%)	Cumulative share (%) of the Relative Net Margin (RNM)	Analysis of observations
X	≈9%	0%	Roughly 9% of wholesalers' population have a zero RNM
A	≈2%	(-)1%	2% of the wholesalers' population have a negative RNM of 1%
D	≈18%	4%	18% of the wholesalers' population have a RNM of 4%
F	30%	12%	30% of the wholesalers' population hold a RNM of 12%
H	50%	28%	50% of the wholesalers' population hold a RNM of 28%
J	80%	40%	80% of the wholesalers' population hold a RNM of 40%

Note: This Table is constructed from Figure 1 observations.

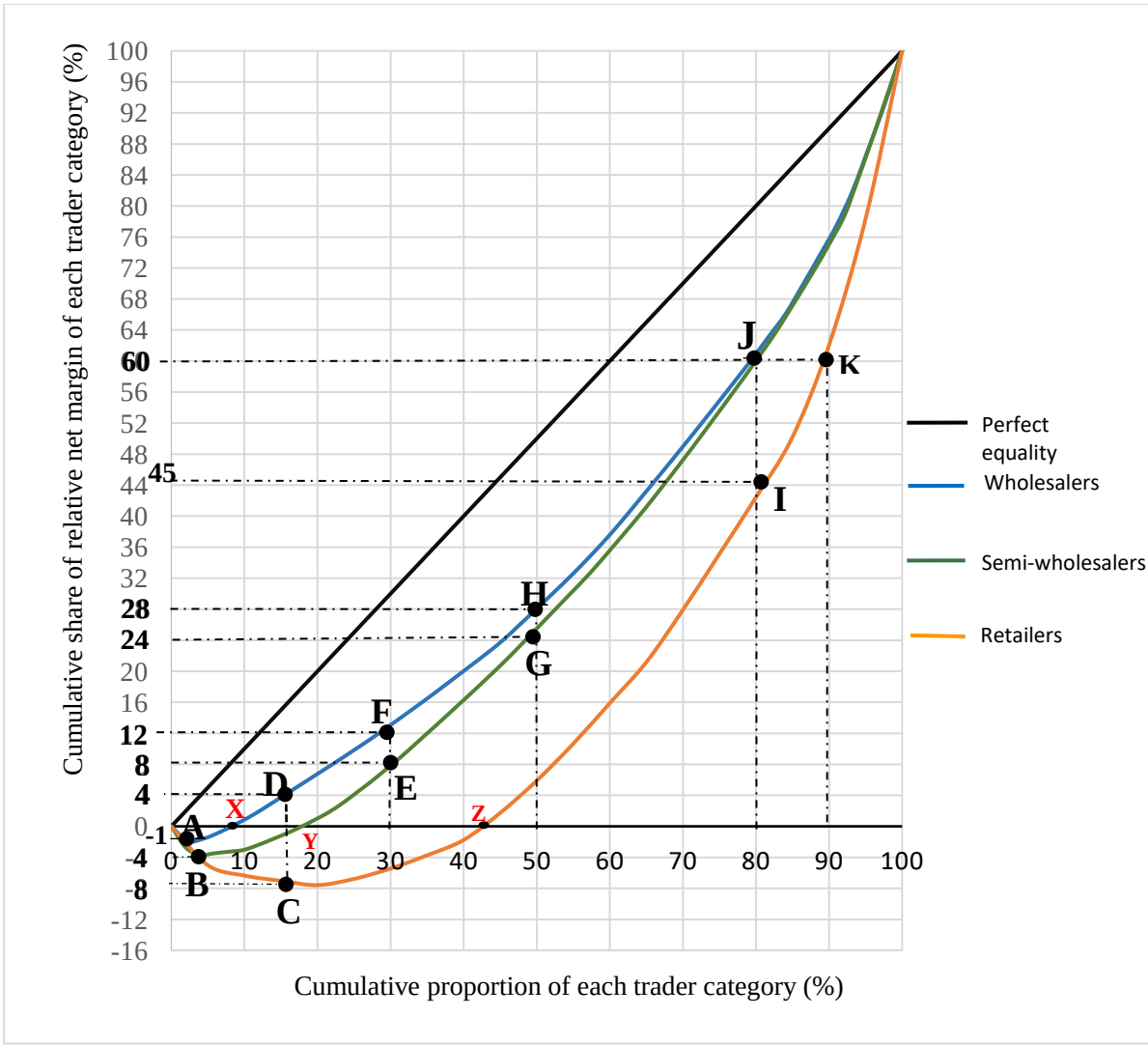

Figure 1: Lorenz curve of the net margin of cassava flour by trader categories.

Table 3: Gini coefficient computed by trader categories in the marketing channel of cassava flour in Yaoundé.

	Category of traders			All categories of traders (N=515)
	Wholesalers (N=144)	**Semi-wholesalers (N=151)**	**Retailers (N=220)**	
Gini coefficient	0.340	0.394	0.753	0.441
Difference of Gini coefficient between trader categories	0.054	0.359		0.959

Table 4: Atkinson index computed in function of levels of inequality aversion for different trader categories of cassava flour in Yaoundé.

Level of inequality aversion (ε)	Category of traders			All categories of traders (N=515)
	Wholesalers (N=144)	Semi-wholesalers (N=151)	Retailers (N=220)	
ε=3	0.365	0.619	0.703	0.807
ε=5	0.607	0.788	0.796	0.908
ε=7	0.706	0.832	0.827	0.932
ε=9	0.748	0.850	0.843	0.943
ε=11	0.771	0.861	0.852	0.948
ε=13	0.785	0.867	0.858	0.952
ε=15	0.795	0.872	0.863	0.954
ε=17	0.801	0.875	0.866	0.956
ε=19	0.807	0.877	0.869	0.957
ε=21	0.811	0.879	0.871	0.959

DISCUSSION

In spite of their supplementary expenses, wholesalers recorded higher marketing margins than other trader categories

From Table 1 results, it appears that wholesalers bore higher marketing costs than semi-wholesalers and retailers. This could be justified by the large cassava quantities purchased in rural areas by wholesalers engendering supplementary expenses (e.g. wages for carriers from farm to roadsite, wages for loaders to charge cassava products into cars, insurance costs, bribes to administrative officials, etc.), which were not incurred by other trader categories (semi-wholesalers and retailers) who bought their cassava at the vicinity of urban areas or in different city's neighbourhoods. Besides, as most wholesalers were concurrently producers and processors of cassava that they cultivated in remoted areas, they have to pay high storage and transport costs and/or vehicle maintenance charges (for car owners) in order to transport cassava flour from villages to Yaoundé urban markets. This corroborates findings by Mvodo and Liang (2012) according to which transportation costs, access to paved roads and availability of appropriate warehouses significantly affected the wholesalers' charges in the marketing of cassava flour in Cameroon. Such marketing charges were not however spent by retailers who bore only the rent, tax and storage expenses, which were lower as compared to the above-mentioned costs supported by wholesalers (Mvodo and Liang, 2012) (Table 1).

However, in spite of their supplementary marketing charges, Table 2 results indicate that the wholesalers earned the highest net margins among all trader categories. The results precisely suggest that the yearly average net margins of different trader categories of cassava flour were different in pairs with wholesalers earning the

most (435,022 FCFA), followed in order by semi-wholesalers (333,709 FCFA) and retailers (90,566 FCFA) (Table 2). This might be due to the compensation earned from the economic advantages from the marginal benefit earned by wholesalers from selling supplementary amounts of cassava flour as compared to other trader categories (Mankiw, 2018).

From Table 2 results, the negative signs showed by the minimum gross margins for all trader categories proved that cassava flour marketing was not profitable to all actors involved in this marketing channel. This corroborates findings of a similar study by Njukwe et al. (2014) which asserted that the profit margins of processed cassava products were small due to poor quality products, even though labour investments were high compared with those of medium and large-scale processing factories (Njukwe et al., 2014). Indeed, the conduct of marketing operations are subject to individual capitalism and economic Malthusianism of some actors (wholesalers) who: (i) mobilize the entire marketing exchange flows, (ii) order and make heavy payments at the level of the upstream and downstream markets (Langel, 2012; Komlan et al., 2013). When Dubois (2001) associated this individual capitalism of the actors' basic conservation methods and the fluctuations in the storage of goods in urban markets, the conduct of marketing operations becomes a compromise for number of actors who are waiting for a rebound in the level of prices between the peak and shortage period.

It should be noted that the trader categories who built up stocks of high prices stop their application in supply and try to sell present stocks by limiting the losses to generate positive net margin (Dubois, 2001). However, this latent period is expensive because the capital mobilised to build up stocks are still not amortised. Therefore, this does not allow them to generate positive net margin to limit losses that are not always sufficient to start a new rotation of activities at the end of a period of peak or shortage (Dubois, 2001; Tricochet et al., 2008; Langel, 2012). This failure translated into negative net margins at the level of each trader category (Table 2). In this case, the trading actor did not have good control of the function of exchange associated with the marketing of order flow that defines its activity both downstream and upstream of the marketing chain.

Wholesalers showed more egalitarian Lorenz curve than other trader categories

Figure 1 results illustrate that in terms of ranking, that the wholesalers Lorenz curve was more egalitarian than the semi-wholesalers and retailers; and the Lorenz curve of the semi-wholesalers was still more egalitarian than that of retailers. However, the Lorenz curve of Figure 1 illustrates that in real situations, the marketing activity of the cassava flour in the city of Yaoundé showed the state of unequal distribution of the related net margins within the population of wholesalers, semi-wholesalers and retailers. Thus, FAO (2006) and Langel (2012) drew attention to the fact that the dominance of Lorenz cannot by itself alone explain the issues of distribution of related net margins in terms of equality or inequality (FAO, 2006; Langel, 2012). It was therefore reasonable in this study to conduct an analysis of the Lorenz curve for each trader category. The objective here was to support the best description of the inequality of the Relative Net Margin (RNM) at the level of each trader category identified in the cassava marketing channel.

The one factor ANOVA test performed in Table 2 already indicated that the related average net margins of different categories of traders involved in the marketing of cassava flour in the city of Yaoundé were statistically different at 1% significance level (Table 2). However, at the level of the Lorenz curve, this appeared somehow contradictory. Indeed, there are times that Lorenz curves overlap (FAO, 2006). In this case, the income level of the two populations is the same. This situation was noticeable at the top level of Figure 1, where the Lorenz curve of the wholesalers (in blue) overlapped that of the the semi-wholesalers (in green), thus creating a situation of confusion. It is the representative point J that indexed a combined population of 80% of

wholesalers and semi-wholesalers (Figure 1, Table A1). When you synchronize in the result of the ANOVA test as the Lorenz curve, it must be concluded that at 1% significance level, 20% of the population of wholesalers and semi-wholesalers of cassava flour in the city of Yaoundé had equal average net margins (Figure 1, Tables 2, A1-A3). Thus, the null hypothesis (H_0) of the ANOVA test according to which the related average net margins of trader categories should be equal was verified at a highly significance level for 20% of the population of wholesalers and semi-wholesalers. The alternative hypothesis (H_a) of the ANOVA test stating that the related average net margins of trader categories taken in pairs should be different, was significant at the 1% level for 80% of the population of wholesalers and semi-wholesalers (Figure 1, Tables A1-A3).

Table A2 was derived from Figure 1 in order to comment the semi-wholesalers Lorenz curve (green colour) at the main observation points (Y, A, B, E, G, J). However, it was observable at the base of Figure 1 that the semi-wholesalers Lorenz curve overlapped (FAO, 2006). Indeed, at point B, it worth observing that the base of the Lorenz curve of semi-wholesalers (in green) blended and overlapped that of the retailers Lorenz curve (in red color) from a combination of less than 5% of the population of the trading actors of cassava flour. When they merged, the null hypothesis (H_0) of the ANOVA test stating that the related average net margins of trader categories should be equal was verified at a highly significant level to 5% of the population of semi-wholesalers and retailers. When they overlapped, the alternative hypothesis (H_a) of the ANOVA test according to which the related average net margins of trader categories taken in pairs should be different was significant at the 1% threshold for 95% of the population of the semi-wholesalers and retailers (Table 2).

As regards to the Lorenz curve of retailers (Figure 1), a large part of it laid below the x-axis to the point Y indicating a percentage of 41% of the total of the population of retailers. Given that the Lorenz curve of retaillers was furthest from the right of equi-distribution of the wholesalers and the semi-wholesalers Lorenz curve, it could be concluded as emphasised by Langel (2012) that the level of inequality was high in the distribution of Relative Net Margin (RNM) between retailers of cassava flour in the city of Yaoundé. Table A3 was associated with the observations of the retailers Lorenz curve of Figure 1 (red colour). It analysed data arising from the retailers Lorenz curve at the main observation points (Z, B, C, I, K).

To sum up, it is important to note from the analysis of the Lorenz curves of the different trader categories that the distribution of the Relative Net Margin (RNM) of retailers was highly unequal. The distribution of semi-wholesalers was more or less unequal compared to wholesalers who remained less unequal compared to retailers. These observations confirmed the existence of asymmetry of information by stratum of income for each trader category involved in the marketing of cassava flour in the city of Yaoundé. However, the information asymmetry was low among wholesalers, high among the semi-wholesalers and very high among retailers. However, to give a real value to the deviations of observed inequality (the surface area between the diagonal of equality and the Lorenz curve of each trader category) between the RNM of traders involved in the marketing of cassava flour in the city of Yaoundé, FAO (2006) recommended to use the Gini coefficient which is the most frequently used indicator of inequality.

Gini coefficient was the lowest for wholesalers who were less willing to sacrifice for equity than other trader categories according to Atkinson index

From Table 3 results, the Gini coefficient was the lowest for wholesalers, followed in the order by semi-wholesalers and retailers. However, as shown in Table 3 (first row), the aggregate Gini coefficient for all trader categories was 0.441, which was closer to the value of 0.466 representing the Gini coefficient of income distribution within the Cameroonian population (Mussard et al., 2003; World Bank, 2019). The computed value also

approached the World Bank data according to which, between 1981 and 2013, the Gini coefficient ranged between 0.3 and 0.6 worldwide (World Bank, 2019).

In Table 3, the increasing distribution of the Gini coefficient showed that there were inequalities in Relative Net Margin (RNM) between trader categories in the marketing of cassava flour in the city of Yaoundé. This result agreed with that of the one-way ANOVA test (Table 2) which indicated that, the related average net margins of various categories of traders involved in the marketing of cassava flour in the city of Yaoundé were significantly different at 1% significance level. However, by using the Mussard et al. (2003) methodology, the analysis by the difference of the Gini coefficient in intergroup between wholesalers, semi-wholesalers revealed that the Gini coefficient increased by 0.054 (i.e. 0.394 *minus* 0.340) between wholesalers and semi-wholesalers, by 0.413 (i.e. 0.753 *minus* 0.340) between wholesalers and retailers and by 0.359 (i.e. 0.753 *minus* 0.394) between semi-wholesalers and retailers (Table 3). For example, if the average net margin of different trader categories of cassava flour in the city of Yaoundé were different taken in pairs, the level of inequality between two categories of traders would remain very low between wholesalers and semi-wholesalers and very high between semi-wholesalers-retailers and wholesalers-retailers. The asymmetry of information was so low for the wholesalers and semi-wholesalers and very high for the retailers. Dubois (2001) justified this situation by the fact that economic competition requires the strongest, or most qualified (wholesalers and semi-wholesalers) to regroup through "selective pairings" instead to supply areas; selective pairings that provide some security and allow them to impose themselves on the different markets in the city of Yaoundé. In doing so, they leave aside the weakest and least qualified i.e. retailers (Dubois, 2001).

In short, the Gini coefficients (Table 3) demonstrated the existence of inequalities between the Relative Net Margin (RNM) of trader categories in the marketing of cassava flour in the city of Yaoundé. These inequalities were tangible evidence that there existed indeed information asymmetry on the cassava flour market in the city of Yaoundé. This asymmetry appeared all the same egalitarian for wholesalers versus semi-wholesalers; but appeared very unequal at the levels of wholesalers versus retailers and semi-wholesalers versus retailers. Thus, when the wholesalers and semi-wholesalers enriched themselves in the marketing of cassava flour, retailers became more impoverished. This difference of inequality originated in better control of the bottom-up and top-down marketing flow by wholesalers and semi-wholesalers to the detriment of retailers more committed to master the top-down marketing flow. Retailers then suffered from their ignorance on the upward flow of commercialisation of cassava flour in the city of Yaoundé.

In order to supplement the weaknesses of the Gini coefficient, this study used the Atkinson index in order to assess how each trader category was prepared to give up increasing shares of total income in order to achieve equality in incomes. Cited literature always connected the Atkinson index with a social welfare function which was represented by average utility and a parameter of inequality aversion (ε) (Atkinson, 1970; Bellù and Liberati, 2006; FAO, 2007; Abdelateif, 2013; Mankiw, 2018).

In general, the value of Atkinson index increases when society attaches a higher weight to the lower income groups with rising ε (FAO, 2007; Abdelateif, 2013; Abdelateif and Omima, 2015; Mankiw, 2018). Table 4 results confirmed this trend by showing that if ε rose from 3 to 21, the Atkinson index for the distribution of net margin would increase from 0.365 to 0.811 for wholesalers; from 0.619 to 0.879 for semi-wholesalers; from 0.703 to 0.871 for retailers; and from 0.807 to 0.959 for all trader categories (Table 4). Hence, in order to have equally distributed net margins in the study area, the retailers were ready to give up much more of their net margin than semi-wholesalers and wholesalers. Likewise, semi-wholesalers were more willing to sacrifice for

equity than wholesalers. This testified the asymmetry of information among the trader categories, which could be reduced if:

(i)-The cassava flour merchants were organised themselves into groups of merchants by category of actor so that at each level of group and intergroup, information flows would be improved to timely inform all actors.

(ii)-The cassava flour merchants cultivated a strong commercial leadership where the big traders (capitalists) initiated the marginalised small shopkeepers to effectively manage marketing flows up and downstream along market channels.

(iii)-The Cameroonian government accompanied agricultural development projects involved in the marketing of cassava and other food crops to promote establishment of a productive partnership between existing agricultural cooperatives and groups of traders. These projects should exploit existing opportunities of partnership with wholesalers, improve marketing information system by collecting, colating, analysing and making information available to all trader categories at all times. They should also strengthen the management capacities of the trader organisations to improve their negotiations skills and enhance processing ability of quality cassava flour and other by-products.

Table A2: Analysis of observations at different points of the semi-wholesalers Lorenz curve.

Observation point	Cumulation of the population of semi-wholesalers (%)	Cumulative share (%) of the Relative Net Margin (RNM)	Analysis of observations
Y	≈19%	0%	19% of semi-wholesalers' population have a zero RNM
A	≈2%	(-)1%	2% of the semi-wholesalers' population have a negative RNM of 1%
B	≈3%	(-)4%	3% of the semi-wholesalers' population have a negative RNM of 4%
E	30%	8%	30% of the semi-wholesalers' population have a RNM of 8%
G	50%	24%	50% of the semi-wholesalers' population have a RNM of 24%
J	80%	60%	80% of the semi-wholesalers' population have a RNM of 60%

Note: This Table is constructed from Figure 1 observations.

Table A3: Analysis of observations at different points of the retailers Lorenz curve.

Observation point	Cumulation of the population of retailers (%)	Cumulative share (%) of the Relative Net Margin (RNM)	Analysis of observations
Z	≈41%	0%	Loosely, 41% of retailers' population have a zero RNM
B	≈3%	(-)4%	Approximately, 3% of the retailers' population have a negative RNM of 4%
C	≈18%	(-)8%	18% of the retailers' population have a negative RNM of 8%
I	80%	45%	80% of the retailers' population have a RNM of 45%
K	90%	60%	90% of the retailers' population have a RNM of 60%

Note: This Table is constructed from Figure 1 observations.

Table A4: Number of trader categories selected in the main cassava flour markets within the seven sub-divisions of Yaoundé-city.

Yaoundé sub-division	Market name	Category of traders			TOTAL
		Wholesalers	Semi-wholesalers	Retailers	
Yaoundé I	Elig-Edzoa	15	20	20	55
	Etoudi	12	16	24	52
	Mfoundi	15	15	22	52
Yaoundé II	Mokolo	14	15	26	55
Yaoundé III	Nsam-Efoulan	11	11	21	43
Yaoundé IV	Ekounou	22	12	20	54
	Mvog-Mbi	13	20	21	54
Yaoundé V	Essos	17	15	21	53
Yaoundé VI	Acacia	14	16	20	50
Yaoundé VII	Nkolbisson	11	11	25	47
TOTAL		144	151	220	515

Conclusion

From the main findings of this study, it is plausible to conclude that there exists a high concentration of three trader categories (wholesalers, semi-wholesalers and retailers) involved in the marketing of cassava flour (fufu) in the Yaoundé urban markets. The results of the one-way ANOVA test indicated that the average net margins of the different actors involved in the trade of cassava flour in the Yaoundé-city were different in pairs (two trader categories taken at a time). When the results of the one-way ANOVA test were synchronized with the Lorenz curve, the conclusion is that at 1% significance level, 20% of the population of wholesalers and semi-wholesalers of cassava flour in the Yaoundé urban markets had equal average net margins. Further analysis of the Lorenz curves of the different trader categories of cassava flour in the city of Yaoundé showed that the distribution of the relative net margin (RNM)

to the retail level was highly unequal. Thus, the semi-wholesalers were more or less unequal compared to wholesalers who rested less unequal compared to retailers. These results confirmed the existence of asymmetry of information with regard to strata of income for each category of actors in the marketing of cassava flour in the Yaoundé urban markets. The results further indicated that this asymmetry of information was low among wholesalers and semi-wholesalers; but was very high among retailers.

The analysis by difference of the Gini index in intergroup (between the semi-wholesalers, wholesalers and retailers) in the cassava flour market of the urban markets of Yaoundé confirmed that inequalities were growing between wholesalers and semi-wholesalers; between wholesalers and retailers and between semi-wholesalers and retailers. This was confirmed with Atkinson index results according to which, in order to have equally distributed net margins in the study area, the retailers would be ready to give up much more of their net margin than semi-wholesalers and wholesalers. Likewise, semi-wholesalers would be more willing to sacrifice for equity than wholesalers.

Hence, in order to in order to reduce information asymmetry between cassava flour trading partners and achieve fairness among them, the cassava flour traders should organise themselves into groups/cooperatives and should be accompanied by government to promote partnership between trader groups and cooperatives and to improve their negotiation skills and marketing information systems.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

JAAA interviewed the participants and conceived the research protocol. AJJF conceived the study design, did the statistical analysis and data modelling and reviewing of the manuscript. GAM initiated the write up of the manuscript and participated in the English proof reading of the article.

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