

# Poultry Price and Market Analysis in the South West Region of Cameroon

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**Abstract** The price transmission of agricultural product along its supply chain and the integration of its market is an important factor in ensuring the efficiency of markets. The study had as main objective to analyze the price transmission and integration between poultry markets in relation to its supply chain. The data used was basically primary, obtained through administering of sixty questionnaires at random within the various markets in the Sub-divisions within Fako Division. The study constituted and econometric model relating the market price to key price transmission parameters such as farm gate price and the cost of transaction which was used for analysis. Results show that the farm gate price and the transaction cost had a positive relationship with the retail price of poultry products in this division, but with a negligible effect on the retail price as compared to the farm gate price. Also, there existed a high correlation coefficient between poultry markets in this division indicating that the markets are integrated and the existed a level of symmetry in poultry prices in this division. Hence based on these findings, the government should put appropriate measures to ensure that poultry prices remain stable and all actors involved in the poultry sub sector are informed through various communication methods to ensure symmetry in the transmission of poultry prices which improve on the welfare of producers and consumers of poultry products.

**Keywords:** cameroon, poultry, farm-gate price, market price, market analysis

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## 1. Introduction

Cameroon produces a variety of agricultural commodities both for export and domestic consumption. Cocoa and coffee are grown in the Centre and South regions, bananas in the South West region and cotton in several parts of the North region. Animal husbandry is practiced throughout the country with poultry-farming, pig keeping and cattle rearing predominant in the Northern part of the country. Chicken is highly consumed throughout the world and accounts for about 30% of total meat production worldwide and remain a high source of protein. The poultry sub-sector of Fako-Division has witnessed tremendous growth over the past decades. The rapid growth of poultry production in this division has largely been propelled by the participation of the private sector which has been facilitated through infrastructural development in the division.

The poultry meat market in Cameroon has grown steadily in value and volume within the last decades as shown in Figure 1. There was marked increase in supply since 1960s and beyond the 1970s followed by declines from early 1980s to mid-1990s explained by a prolonged period of economic downturn culminating in economic and political emergency. The evolution of real per capita incomes and inflation for Cameroon affected the poultry

meat sector especially in the mid-1990s. However, there has been a steady supply of poultry meat as food item since the late 1990s and this even peaked in 2007. The increasing trends in production and productivity can be accounted for by agricultural and livestock policy reforms in the early 2000s. The macroeconomic and agricultural policy measures in late 1990s and early 2000s not only reduced inflation but stabilized market prices, implemented exchange rates that better reflect market realities, there was significant diminution of export taxes and a greatly enhanced role for the market in determining agricultural prices. This is seen by the steep increase in poultry meat output from the late 1990s to the mid-2000s. The liberalization of the market increased supply. However, the ban on imported frozen chicken in 2006 incentivized domestic producers to increase their market share, though the supply response was weaker.

The recent poultry crisis (bird flu) coupled with numerous allegations of price fixing and other non-competitive practices by some players in the poultry value chain in the country, specifically in Fako-Division of the South West region has rekindled interest on how prices are transmitted along the chain of production. This study aims at determining the producer (farm) – retail price transmission behavior in Fako poultry industry. Price transmission studies has been used to understand the functions of agricultural markets and how food prices are determined and transmitted along the entire supply chain

particularly in times of food crises. Despite remarkable progress in the poultry industry in the division in recent years, the industry still faces persistent problems in the light of excessive price fluctuations which cause considerable hardship to producers and actors along the supply chain. Due to prolonged low prices in most parts of this Division in the last few years, the government intervenes by introducing price control schemes with aim at controlling excessive price fluctuations to ensure acceptable price for poultry products across the division and the country at large.

Poultry production in general has become a lucrative sector in most parts of the country especially in the West, Centre, North West and South West regions due to the high demand by its inhabitants because of its high protein content. The poultry sector in Fako Division shows marked volatility in prices as the prices of other commodities in this region of the country. However, these prices shocks are transmitted between different supply chain stages (i.e. producers, wholesalers and retailers) and the spread of price from farm to the retailers remain largely unknown. Furthermore, the level of integration between this market in the division and other markets within the country and the price formation process is unknown. It should be noted that market power might be an important explanation of any evidence of asymmetry in poultry prices in this division, but it may not be the only causal factor. That is, incomplete or asymmetric price transmission may take place due to a number of other reasons. In fact, Peltzman [6] argues that asymmetric price transmission may be characteristic of competitive as well as oligopolistic market structures and it cannot simply be concluded that asymmetric price transmission implies market power. Other factors that could also be the cause of asymmetric transmission of poultry prices in this division include; high transaction cost, inadequate or inefficient government policies (e.g. price regulation

and subsidies), inadequate information and poor inventory management along the value chain.

Asymmetric price transmission of poultry-meat along its supply chain will lead to higher prices to consumers, which will cause a fall in the demand for poultry-meat and a shift to the consumption of its substitute. This will reduce poultry farmers' income due to the shift to the consumption of its substitute. Due to asymmetric price transmission nutritional insecurity can occur especially for consumers who prefer chicken from other meat. This could lead to health problems arising due to lack of balance diet since poultry meat is a rich source of protein but they can't afford because of high prices. Based on the aforementioned challenges, the following questions could be raised: what are the effects of price asymmetry on actors along the supply chain? Is there a relationship between price received at farm gate and that in the urban markets in Fako Division? The main goal of this study is to analyze the price and market for poultry meat in relation to its supply chain. We statistically test the Null hypotheses that there is no relationship between farm and market prices of poultry-meat in Fako-division, and that there is no asymmetry in poultry prices along its supply chain in Fako-Division. The fact that poultry production has generally become a lucrative sector in most parts of the country, and this study being an educational practice is necessary to investigate the market margin for poultry meat and provide solutions to address asymmetric or inappropriate price transmission after being aware of the key factors which can account for such effects. This research is of interest to producers of poultry products to help them be aware on how poultry prices are transmitted along the supply chain and having this knowledge, they will be able to know what price to charge wholesalers so that they don't make high profit at the expense of both the producers and the consumers.

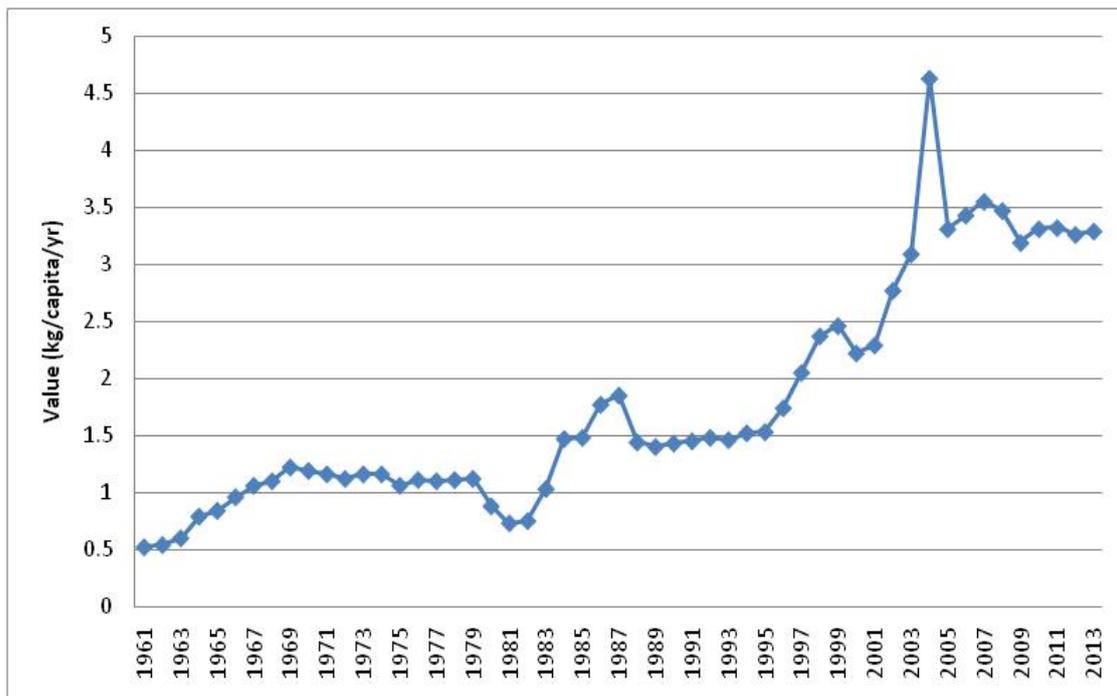


Figure 1. Value of Poultry Meat as Food Supply in Cameroon, 1961 – 2013 (Source: authors' computation from FAOSTAT)

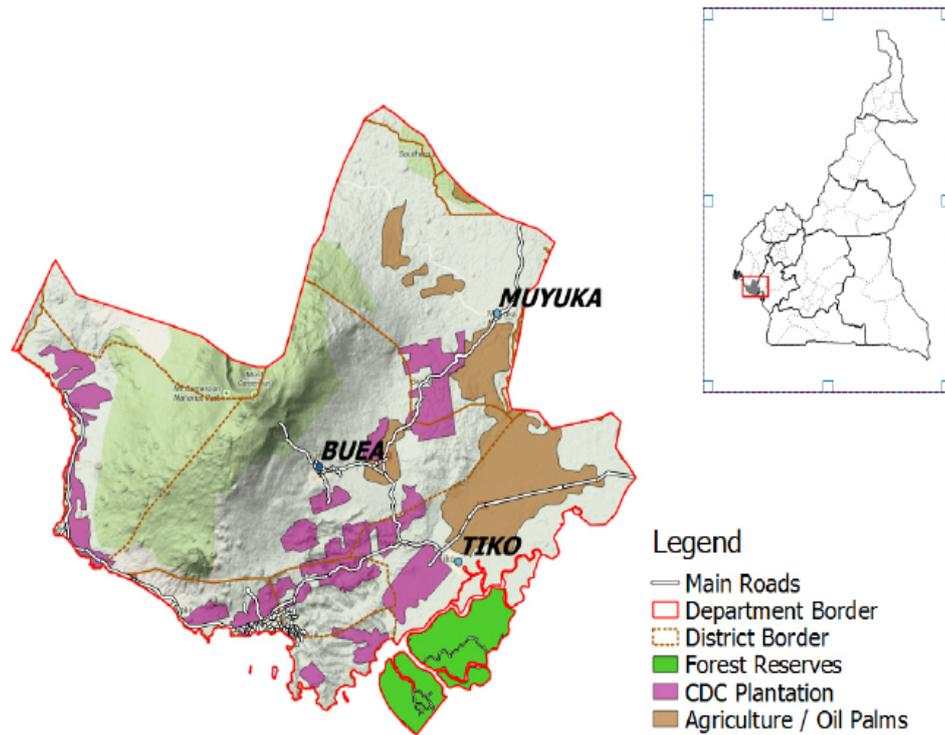


Figure 2. Map of Fako Division (Source: mapcarta, 2017)

## 2. Materials and Methods

### 2.1. Study Area

Fako-Division is located in the Southwest Region of Cameroon. This division is further divided into 5 Sub-Divisions which includes Buea, Muyuka, Tiko, Limbe and Idenau. Agriculture is the major economic activity of the people, employing a large proportion of the population with Tomatoes, plantain, maize, cassava, and cocoyam as the main or most common food crops and poultry, pigs, goats and to a lesser extent cattle as the domesticated livestock. Figure 2 shows the map of Fako Division showing its various Sub-Divisions and major cities surrounding this Division.

### 2.2. Analytical Framework

Due to unavailability of accurate and adequate information, researchers make use or rely greatly on certain assumptions guided by economic theory in order to make use of price base techniques such a price transmission econometrics or parity bound models that make use of more than price data. Some of these models include;

#### 2.2.1. Static Regression Models

The Bivariate Regression Models (BRM) of spatial price transmission and market integration analysis are closely related to the BCM in analytical mechanics but different in interpretation [2]. They are commonly specified as;

$$P_t^i = \beta_0 + \beta_1 P_t^j + \beta_2 T_t + \beta_3 R_t + (\varepsilon_t) \quad (1)$$

Where and may be in their first-differenced or logarithms form, is transaction cost, denotes other factors influencing

prices and they are the coefficients to be estimated. The two markets  $i$  and  $j$  are perfectly integrated if Mundlak and Larson [5]; and Gardner and Brooks [3] employed static regression models in analyzing market integration [2].

#### 2.2.2. Parity Bound Models (PBM)

The PBM explicitly consider transaction costs and trade flow data, in addition to price series, in analyzing market integration. Unlike the conventional dynamic approaches, which strictly accept or reject a null hypothesis at a given significance level, PBM have the advantage of allowing for a continuum of inter-market price relationships within the range of perfect market integration and market segmentation. Baulch [1] first applied the PBM to price transmission and market integration analysis. He noted that market integration should not merely be assessed using co-movement of prices, but also transfer costs - transportation, loading and offloading, storage and processing charges, as well as traders' nominal profits. Transfer costs determine the "parity bound" within which the price of a homogenous commodity in two geographically separated markets varies independently [1]. The model builds on the following theory. If are prices of the commodity in two markets  $i$  and  $j$ , assuming that market  $i$  supplies to  $j$ ; and the transactions costs of moving the commodity from market  $i$  to  $j$ , then three regimes that define trade between the markets are defined as follows:

*Regime 1 (located at the parity bounds):* When the transfer costs equal the inter-market price differential i.e.  $P_t^i - P_t^j = C_t^{ij}$ . In this case, given no impediments to trade between the markets, a one-on-one co-movement of prices between the two markets occurs and the spatial arbitrage conditions are binding.

*Regime 2 (located inside the parity bound):* When transfer costs exceed inter-market price differential, i.e.  $P_t^i - P_t^j < C_t^{ij}$ . Here, trade is not expected to occur where

producer and consumer markets are specialized since profitable arbitrage opportunities are exhausted. Where there is no specialization of production and consumption between the market pairs, market  $i$  ships to market  $j$ .

*Regime 3 (located outside the parity bound):* When the price spread exceeds the transfer costs i.e.  $P_i^i - P_i^j > C_t^{ij}$ . Here, the spatial arbitrage conditions are violated. This could indicate that impediments to trade exist and are prime for market segmentation. In this case, market  $j$  ships to market  $i$ . It is worth stating that; regime 1 is consistent with the theory of market integration only where production and consumption areas are completely distinct. When production and consumption areas are non-specialized, then regimes 2 and 3 are consistent with the concept of market integration, and there exists between markets a higher likelihood of trade flow reversals depending on the magnitude and sign of the inter-market price differentials.

### 2.2.3. Pre-co Integration Approaches to Testing for APT

Different authors use different notations, making it difficult to compare approaches. In the following,  $pt^{out}$  is a firm's output price in period  $t$ . Furthermore, we assume that  $pt^{out}$  is caused by  $pt^{in}$ , the input price in  $t$ . Assuming symmetric and linear price transmission, the following equation can be used:

$$p_t^{out} = \alpha + \beta_1 p_t^{in} + \mu_t \quad (2)$$

There is a long history of estimating asymmetric adjustment in the broader sense of irreversibility. Tveeten & Quance [4] use a dummy variable technique to estimate irreversible supply functions. Equation (2) is a translation of their original equation for supply analysis into the context of APT using the notation:

$$p_t^{out} = \alpha + \beta_1^+ D_t^+ p_t^{in} + \beta_1^- D_t^- p_t^{in} + \varepsilon_t \quad (3)$$

where  $+D_t$  and  $D_t^-$  are dummy variables with:  $D_t^+ = 1$  if  $pt^{in} \geq pt^{in-1}$  and  $D_t^+ = 0$  otherwise;  $-D_t = 1$  if  $pt^{in} < pt^{in-1}$  and  $D_t^- = 0$  otherwise. By means of these dummy variables, the input price is split into one variable that includes only increasing input prices and another that includes only decreasing input prices. As a result, two input price adjustment coefficients are estimated, not one as in equation (1); these are  $\beta_1^+$  for the increasing input price phases and  $-\beta_1^-$  for the decreasing input price phases. Symmetric price transmission is rejected if  $\beta_1^+$  and  $-\beta_1^-$  are significantly different from one another, which can be evaluated using an F-test.

## 2.3. Empirical Model

In analyzing the price transmission of poultry-meat along its supply chain, and evaluating the relationship that exist between farm gate and retail price the technical relationship maybe hypothesized as:

$$R_p = a + bF_p + cTC + \varepsilon \quad (4)$$

Where  $R_p$  is the retail price of poultry meat in different markets,  $F_p$  is the farm price of poultry meat charged by producers,  $TC$  is the transaction cost from farm to the market,  $b$  and  $c$  are coefficients to be estimated,  $\varepsilon$  is the

error term and a constant term. From the above equation the elasticity of the retail price with respect to farm price can be obtain as:

$$dR_p / dF_p = R_p / F_p \quad (5)$$

Also, that of the retail price with respect to the cost of transaction can be obtain as;

$$dR_p / dTC = R_p / TC \quad (6)$$

Where equation (5) and (6) are derived from the differentiation of equation (4) with respect to farm price and total cost of transaction respectively. However, the plausibility of a non-linear relationship between these prices and transaction cost is also tested as follows:

$$R_p = aF_p^b TC^c \quad (7)$$

This is linearised as:

$$\ln R_p = \ln a + b \ln F_p + c \ln TC + \varepsilon \quad (8)$$

In equation (5) the elasticity coefficient  $b$  and  $c$  indicate the response of retail price with respect to farm price and the cost of transaction respectively. The above equations show the independent variables which are farm price and the cost of transportation and the dependent variable which is the retail price. All of the above-mentioned variables are measured in FCFA. Farm price is the price charged for a bird after marketing cost such as taxes, transportation have not yet been deducted, the transaction cost is the cost incurred in transporting the birds from the farm by the retailers to the market. The retail price is the price charged per bird after transaction cost such as taxes and transportation have been included. The independent variables show the extent to which  $R_p$  is being affected by  $F_p$  and  $T_c$ .

Using the principles of economic theory, which refers to the signs and size of the parameters of the economic relationships. From the above equations, we expect a positive relationship between the retail price and the farm price i.e. an increase in the farm gate price of poultry-meat will lead to an increase in the retail price and we expect the coefficient of the farm price ( $b$ ) to be positive. Also, the coefficient of the total cost of transaction,  $c$  is expected to be positive, and an increase in the total cost incurred in transaction should lead to an increase in the retail price of poultry meat. Furthermore, that *a priori*, proximity and trade intensity are important determinants of the speed of the price transmission process and retailers or processors respond more rapidly when their margins are squeezed than when they are stretch. Samuelson [8] and Takayama and Judge [9] postulated that price transmission is complete when equilibrium prices of commodity sold on competitive foreign and domestic market differ only by transfer cost when converted to a common currency. Popovics [7] used the ARDL to test for price transmission and asymmetry in the supply chain and the direction of causality in the supply chain. The study found the presence of positive or upward asymmetry in the whole chain. The study then attributed the symmetry to oligopolistic markets structure or market power. The results of the granger causality tests also showed that the direction of causality in the chain was upstream. The studies went on to deduce that the price determination

process moved upstream in the production-processing stage indicating that transmission of prices was based on the value added in production rather than the market. in the supply chain.

## 2.4. Nature and Source of Data

The main data used for this study was primary data. The researcher made use of questionnaires which was the main instrument was consisting of both open and close ended questions: structured into five sections. Data was obtained from producers, whole sellers and retailers of poultry-meat in Fako-Division through observations and personal interviews during questionnaire administration. Information on poultry prices both on previous and present prices, for an estimated period of time was obtained. Secondary data collected from textbooks, journals, articles and also data which were based on the accuracy of human brains in retaining and giving information on previous poultry prices were also obtained. This division was divided into three strata (Sub-divisions), Buea market, Muyuka market and Tiko market and random sampling was done in these markets through the administering of questionnaires to both male and female producers and sellers of poultry meat. In order to ease data collection, the sample size was estimated and the number was divided by the number of markets and this helped us to determine the number of sellers to be interviewed in each sampled market. The sampling size for this study was estimated to be 60, with 20 questionnaires administered in each market. The formula used for calculating the sample size is  $n = (Z\alpha/2\alpha)/E$ , where  $n$  is the sample size of the study,  $E$  is the error or population mean (assumed to be 1), and  $\alpha$  is the population standard deviation (3.95). Assuming a 95% confidence interval implies  $\alpha_1$  is equal to 0.05 while  $\alpha_2$  is 0.025. In the standard normal distribution table,  $Z$  is 1.96. Hence,  $n = (1.96 \times 3.95)^2 / 1 = 59.93=60$ . The questionnaires were administered at random in these

markets with no preferential treatment given to any particular group.

In Figure 3 it is observed that 55% of the poultry traders are women, constituting the majority while 45% are men, constituting the minority. It is further observed that majority of the retailers are women constituting 57% while the men constitute 43%. Also based on the study, it is observed that women and men constitute 50% each as wholesalers of poultry-meat in this Division. Furthermore, both sexes are involved in poultry business constituting 15% as both wholesalers and retailers in the following percentages 56% and 44% respectively.

Age is an important factor with respect to information seeking and affects human behavior. From the sampled poultry traders in this division, it shows that 15% of the traders fall in the range 15-25 year, 47% within the range 26-35, 20% within the range 36-45 and 18% of the poultry traders had ages above 45%. Marital status is a key socio-economic factor in ensuring stability of most families and determines the level of resource investment. From the sample drawn, 67% of poultry traders are married, 25% of poultry traders are single, 2% of poultry traders are divorced and 6% of poultry traders in this division are widowed. As such 67% are married while 33% are singled either by haven't gotten married before, by being divorced or widowed. Educational level which affects to a greater extend the life style of people, their cognitive reasoning and the way the make strategic decisions. From the sample, its shows that 5% of poultry traders in Fako-Division have no formal education, 28% have attained primary education, 43% have attained secondary education and 22% have attained University (higher education) while 2% have attained other certificates like training. Most activities of individuals today is affected by their beliefs and also to a greater extend their various denominations. From the sample drawn in the various markets in this division, it shows that 97% of poultry traders are Christians while the remaining three percent are Muslims.

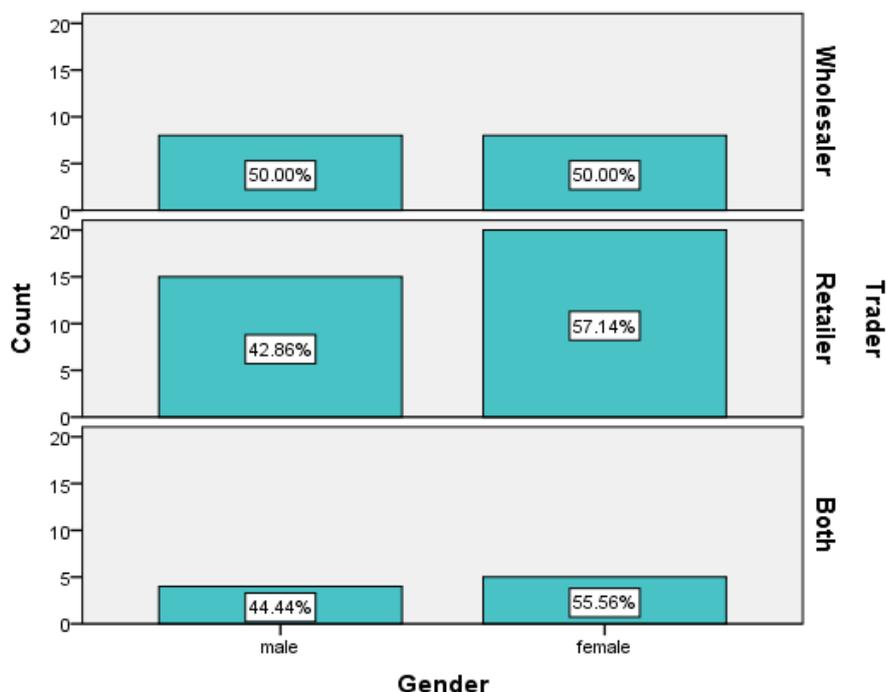


Figure 3. Gender and Type of Poultry Traders in Fako Division (Source: Field survey 2017)

### 3. Results and Discussion

#### 3.1. Resources, Market Structure and Infrastructure

Base on weather traders of poultry meat in this division are fully involve or carry out this economic activity as part time will have an effect on their lively holds especially the impact of price which is a salient marketing feature among other marketing features. From the field survey, its shows that 75% of poultry traders are fully involve in this activity while the remaining 25% carry out this economic activity as part time just to raise extra revenue. From this, it shows that in situations of negative shock in the poultry sub-sector especially decrease in poultry prices or their fluctuations will affect a majority of the poultry traders and in situation of positive feedback, their lively hold will be improved. From the survey conducted, 84% of poultry traders market the hybrid chicken only, 3% market the local breed only and 14% of poultry traders in this division market both local and hybrid. Hence it can clearly be seen, in figure 3, that the poultry sub sector in this division is dominated by hybrid and if there exist a negative shock in this industry with respect to hybrid birds a greater effect will be felt since the hybrid dominate the market, and if there is a negative shock on the local breed its impact on poultry traders in this division will be minimal since most of them sell but the hybrid and can forget about the local breed during the shock.

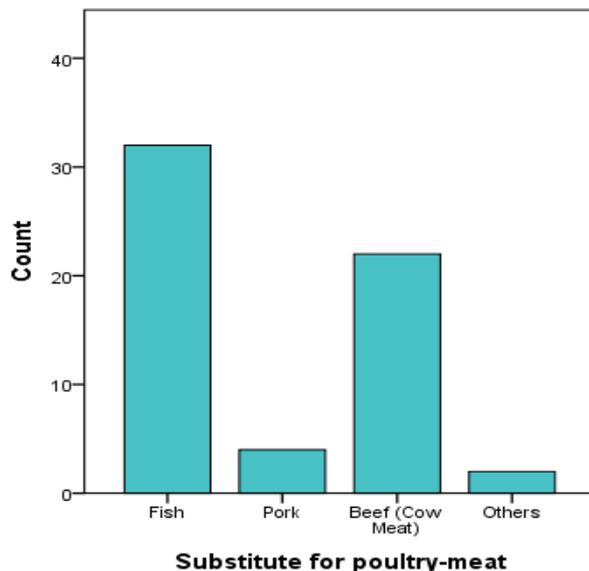


Figure 4. Breed of Poultry Marketed (Source: Field Survey 2017)

Base on the bar chart above it shows that the inhabitants of this Division consume more of the Hybrid chicken than the local bird since in the market place, the hybrid are of majority. Based on each trader's scale of operation, it will affect the price he/she will give out for a chicken of an average weight of 2.5kg. Large scale dealers will be able to sell at lower prices and benefit from economies of scale as opposed to small scale dealers. From the sample drawn, 58% of poultry traders operate on small scale, 34% are medium scale dealers and 8% are large scale dealers.

The basis by which traders in this division charge their chicken will to a certain extend affect the price trend and

poultry price transmission along the supply chain. From the survey conducted, it shows that 47% of poultry traders charged their prices base on the Weight, 18% base on the breed and weight, 5% base on the breed of chicken and the remaining 30% charge their prices base on other characteristics like the cost of purchase and the size of the chicken. Price of poultry-meat at any particular point in time will either have a positive feedback or a negative shock to actors along the supply chain. From the sample drawn, 58% of poultry traders in this division are retailers, 26% are wholesalers and 15% of the traders are both retailers and wholesalers.

Transportation is a key factor of price transmission, the mode of transportation and road nature being the underlying reason for the difference in price between different actors along the supply chain from farm gate to market. Based on the survey, 43% of poultry traders in this division use motor bikes as means of transport, 42% use vehicles, 12% transport their chicken manually and 3% use other method of transportation like trucks etc.

The cost of transportation which traders incur is a function of the state of the road and has an effect on the level of transmission of poultry prices, since traders will want to cover up the cost incurred. From the sample, 42% of traders are of the opinion that road are good, 28% of the opinion that roads are bad while 20% and 10% are of the opinion that road are very good and very bad respectively.

Grants in all its form is an important motivational factor to farmers as a whole in reducing their cost of production, there by affecting the prices of their produce i.e. its transmission along the supply chain. From the sample, 3% of poultry traders consented to have received government grants while 97% consented not to have received government grants at all. From the data, it shows that poultry traders in this division do not receive grants from the government which is an important source of motivation for these traders in the informal sector. On the basis of transportation, traders in this division from the sample drawn have a frequency of going to the market twice a week with an average transportation cost of 14600 FCFA with a mean cost of 4800FCFA from supplier to warehouse.

The rate of price transmission is highly affected with the level by which various agents and consumers of poultry meat are informed on the current situation with respect to poultry prices and other things affecting the poultry industry. From the sample drawn 99% of traders seek information on poultry especially from their suppliers and veterinary while 1% of these sampled traders do not seek information. Also base on the sample drawn, a negligible portion of the traders' focus on obtaining information through communication media like Radio and newspapers.

#### 3.2. Economic Profile of Traders and Consumers

From the data collected, the number of birds sold per week varies from trader to trader, with wholesalers having a mean average of 135 birds sold per week, retailers having a mean average of 80 birds sold per week while both wholesalers and retailers have a mean average of 95 birds sold per week. From the above data it clearly shows that the number of birds sold per week will depend on the scale of operation of each poultry trader. From the data

collected, the price of poultry varies especially during festive periods and when there is an outbreak of disease. An average bird weighs 2.5kg from the data collected and is sold at a mean price of 2900FCFA in the farm and 3400FCFA at the open market, this same bird is sold at a mean price of 3500FCFA and 4000FCFA during festive periods respectively.

The difference in price along the supply chain from producer's right up to the retailers is the reason for marketing margins. From the data collected, it shows that 55% of poultry traders are for the fact that the difference in prices along the supply chain is due to transportation cost, 15% due to market management cost, 3% due to increase low demand, 10% due to perception of risk, and 17% of the poultry traders said the differences was due other factors like, the trader needs to make profit and pay for his/her own time in order to stay in business.

The price of inputs used in poultry farms has a great effect on the price that will be transmitted along the supply chain of poultry products, the fluctuation of agricultural inputs as a whole has a negative or positive effect on farmers but in most cases in negative shock since the prices are always low, there by affecting their incomes negatively. From the data collected, 98% of poultry traders where for the fact that the price of input such as maize and medicines tend to fluctuate.

Competition which occurs in nearly all business of life is a very important factor in determining market power within a particular industry and how prices are transmitted, the higher the competition, the lesser the market power and a low level of competition will lead to higher market power being experienced within a particular industry. From the sample drawn, 98% of the traders consented of facing competition while 2% consented of not facing competition.

From the sample, 2% of consumers consumed the local breed only, 45% consume the hybrid only while 53% of the consumers consume both local and hybrid. From this data it shows that the demand for both hybrid and local bird is high but the supply with respect to the local bird is low, so more local birds should be raised and sold in order to compete with the hybrid bird in the market so that hybrid traders wouldn't take the absence of local birds as opportunity in changing their prices which will have a negative effect on consumers leading to price asymmetry within this sector.

The substitute of any product including poultry meat affects the level of demand of that product especially when prices of its substitute are lower than that of the product. From the sample drawn, 53% of consumers will substitute chicken for Fish, 37% for beef (cow meat), 7% for Pork and 3% for others such as bush meat. This data is very important since the price of poultry product will be affected by its substitute especially Fish which constitute a higher percentage followed by cow meat and the rest. Also, all consumers of poultry meat consented with the fact that they consume poultry meat because it is a necessity rather than a sense of pride.

From the sample drawn, based on other cost that these traders incur apart from transportation and storage, all of these traders consented with the fact that the incur cost such as medication cost, and taxes. Some of these traders especially wholesalers also incur cost like wages paid to

hired workers. Also 90% of these traders consented to the fact that all these cost that they incur affect their decision to stay in the business and their scale of operation while 10% consented of not being affected on their decision to stay and expand in this sector. From this, if the government could provide input subsidies and grants in others forms to these poultry traders these will reduce the cost they incur in the business which will affect their scale of operation positively and decision to remain in this sector there by fighting unemployment in this informal sector of the economy.

### 3.3. Price Transmission along the Supply Chain

The regression for all the markets combined was first done, and then followed by the regression for the individual strata i.e. Buea markets, Tiko markets and Muyuka market respectively. This study investigates the effect of farm prices and transaction cost on the retail price of poultry meat in Fako Division. From the results obtained from the regression analysis, the coefficient of the constant term (a) is 571.684. This implies that even when farm prices and transaction costs are zero, a price of 571.684 FCFA will be transmitted to the market in this Division. The coefficient of the farm price is 0.972 indicating a positive relationship between the farm gate price and the retail price meaning that a 1% increase in the farm price will lead to a 0.972% increase in the retail price and vice versa. The coefficient of the transaction cost is positive indicating a positive relationship between transaction cost and retail price, a 1% increase in the transaction cost will lead to a 0.001% increase in the retail price of poultry meat. The adjusted coefficient of multiple determination ( $R^2$ ) is 0.924 which implies 92% of changes in the dependent variable (Retail price) of poultry meat are accounted for jointly by the farm price and transaction cost, other variables not included in the model account for the remaining 8%. The D-W statistic value is 1.993 and that read from the table with  $k=5$  and  $n=60$  falls in the region of no autocorrelation there for our estimated parameters are reliable and can be use for forecasting. From the t-values calculated, the t-value of the farm price is 24.33 which is greater than the tabulated t-value 1.671: Hence we reject the null hypothesis since the result is significant at 5% level. The t-calculated of the transaction cost is 1.185 which is less than the tabulated t-value (1.671): Hence we fail to reject the null hypothesis as this result is not significant at 5% level. The F-statistic which measures the overall significance has a value of 345.551 and is greater than the F-tabulated which is 2.53, hence we reject the null hypothesis meaning our overall result are significant at 5% and reliable and can be used for policy implementation.

Table 1. All the Markets in Fako-Division

Variables	Coefficients	t-calculated
Constant	571.684	5.200
Farm price	0.972	24.333
Transaction cost	0.001	1.185

Note:  $R^2 = 0.924$ ,  $F^* = 345.551$ ,  
D-W = 1.993, t-tabulated = 1.617  
Source: Computed from survey data, 2017

Estimates for Markets in Buea Sub-division, shown in Table 2, reveal that even when farm prices and transaction cost are zero a price of 982.198 FCFA will be transmitted to the market in this sub division, the coefficient of the farm price is 0.769 indicating a positive relationship between the farm gate price and the retail price meaning that a 1% increase in the farm price will lead to a 0.769%% increase in the retail price and vice versa. The coefficient of the transaction cost is positive indicating a positive relationship between transaction cost and retail prices, a 1% increase in the transaction cost will lead to a 0.012% increase in the retail price of poultry meat. The adjusted coefficient of multiple determination ( $R^2$ ) is 0.77 which implies 77% of changes in the dependent variable (Retail price) of poultry meat in this sub-division is accounted for jointly by the farm price and transaction cost. Other variables not included in the model account for the remaining 23%. The D-W statistic value is 1.541 and that read from the table with  $k=3$  and  $n=20$  falls in the region of no autocorrelation there for our estimated parameters are reliable and can be used for forecasting.

**Table 2. Estimates for Markets in Buea**

Variables	Coefficients	t-statistics
Constant	982.198	3.006
Farm price	0.769	5.488
Transaction cost	0.012	1.185

Note:  $R^2 = 0.77$ ,  $F^* = 34.102$ ,  $D-W = 1.541$ ,  $t$ -tabulated 1.617  
Source: Computed from survey data, 2017

Estimates for Markets in in Tiko Sub-Division, shown in Table 3 indicate that when farm prices and transaction cost are zero a price of 529.181 FCFA will be transmitted to the market in this Sub Division, the coefficient of the farm price is 0.955 indicating a positive relationship between the farm gate price and the retail price meaning that a 1% increase in the farm price will lead to a 0.955%% increase in the retail price and vice versa. The coefficient of the transaction cost is positive indicating a positive relationship between transaction cost and retail price, a 1% increase in the transaction cost will lead to a 0.004% increase in the retail price of poultry meat. The adjusted coefficient of multiple determination is 0.908 which implies 90% of changes in the dependent variable (Retail price) of poultry meat in this Sub-division is accounted for jointly by the farm price and transaction cost, other variables not included in the model account for the remaining 10%. The D-W statistic value is 2.322 and that read from the table with  $k=3$  and  $n=20$  falls in the region of no autocorrelation there for our estimated parameters are reliable and can be used for forecasting.

**Table 3. Estimates for Markets in Tiko**

Variables	Coefficients	t-stat
Constant	529.181	2.027
Farm price	0.955	7.728
Transaction cost	0.004	.645

Note:  $R^2 = 0.908$ ,  $F^* = 94.239$ ,  $D-W = 2.322$ ,  
 $t$ -tabulated = 1.671  
Source: Computed from survey data, 2017

For Markets in Muyuka Sub-Division, when farm prices and transaction cost are zero a price of 631.669

FCFA will be transmitted to the market in this Sub Division, the coefficient of the farm price is 0.971 indicating a positive relationship between the farm gate price and the retail price meaning that a 1% increase in the farm price will lead to a 0.971%% increase in the retail price and vice versa. The coefficient of the transaction cost is positive indicating a positive relationship between transaction cost and retail price; a 1% increase in the transaction cost will lead to a 0.011% increase in the retail price of poultry meat. Since the F-statistic is greater than F-tab, it shows that the overall regression for markets in Muyuka sub-division is statistically significant at 0.5 level.

**Table 4. Estimates for Markets in Muyuka**

Variables	Coefficients	t-stat
Constant	631.669	4.716
Farm price	0.971	16.595
Transaction cost	0.011	-0.023

Note:  $R^2 = 0.968$ ,  $F^* = 286.86$ ,  $D-W = 2.720$ ,  
 $t$ -tabulated = 1.671  
Source: Computed from survey data, 2017

From the above findings, the adjusted coefficient of multiple determination for all the three markets in the various sub-Divisions are very high which indicates that the farm price and the transaction cost have a higher influence on the changes in the retail price. Since the overall significance of the regression (F-statistic) is significant, it shows that all the above regression are significant at 0.5% level. Also based on the findings above, the coefficient for farm prices are significant (based on the student t-test in all three markets) but the coefficient for the transaction cost is not statistically significant using the student t-test but has a positive sign which moves in accordance with a priori expectation. The correlation coefficient for all the above markets are generally high, and because of this, it shows the relationship which exist, between these markets indicating that they are integrated and because this coefficient measures information flow and price communication between markets, it confirms that the marketing system of these markets are integrated with respect to the poultry sub-sector.

## 4. Conclusion

This study examines price transmission of poultry-meat along its supply chain and market integration between markets in Fako-Division of the Southwest Region of Cameroon. It had the specific objective to examine the effect of price asymmetry on actors along the supply chain in Fako-Division, Assessing the relationship that exists between farm prices of poultry-meat and prices received at the market place, and investigate the effect of transaction cost on poultry prices and to analyze the integration between poultry markets in Fako-Division. Primary data was collected with the use of structured questionnaires and the total sample size was 60 which included 20 traders randomly sampled from each market in Buea, Tiko, and Muyuka sub-divisions and the data was analyzed using regression analysis which was facilitated with the use of SPSS. From results obtain, it shows that about 80% of poultry traders in this division carry out this activity full

time and majority of these traders where for the fact that price volatility of poultry-meat affects their income and their lively holds since they obtain the living of their families are base from this job in the informal sector, findings from this study showed that there in integration between poultry markets in this division and there exist a positive relationship between the farm gate prices and that at the retail level. Also based on the findings, transaction cost has a negligible effect on the retail price of poultry meat in this division. Based on the findings, it is possible to recommend that appropriate policies should be put in place through price control measures by setting up floor and ceiling prices to protect both producers of poultry products and the consumers, infrastructural development especially roads or railways, and storage facilities should be made available to help in the reduction of transaction cost and hence improving market integration, and information flow which is an important tool in ensuring price symmetry of any product should be done through various communication means e.g. through radios, television, social medias etc. which will help in enabling all actor along the supply chain and consumers to be aware of current poultry prices which prevents them from being extorted through arbitrage activities practice by some key players in this division.

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