Cointegration and Seasonality In Ghana’s Traditional Fish Trading Industry and its Implications for Intra-regional Trade

Introduction

- This paper examines the evidence for seasonal effects and cointegration between prices of cured or processed fishes traded in major markets of Ghana.
- The behaviour of fish prices is an important factor in trader’s price risk, fisheries policy, development and management in the fisheries sector.

Why seasonality?

- Most agricultural commodities in SSA are subject
- This situation also affects the fisheries sector
- Seasonality cycles if proven can influence trading decisions and reduce price risk
- The possibility of matching fish demand to seasonal availability could reduce the potential for price collapse/price escalation associated with oversupply/excess demand during peak/lean catch or harvest seasons.
- We Test for seasonality of fish products at each market

Why Cointegration?

- Cointegration implies: existence of long-run equilibrium;
- a common stochastic trend;
- the possibility of separation of the short- and long- run relationship among variables.
- It can also be used to improve long-run forecast accuracy (Jin-Lung Lin, 2014)
- Cointegrated prices move together over time – issue or linkages
- Co-integration between two price series implies that two prices may behave in a different way in the short run, but that they will converge toward a common behavior in the long run.

Why Cointegration at particular markets?

- Prices of different fish types in a particular market may or may not be related to one another.
- it gives stakeholders a predictive strategy or traders a trading strategy to use when dealing in the market.
- Any event that affects one product and changes its price relative to others will trigger substitution either in demand or supply.
- Eventually, prices will come back into line – issue of price arbitrage
- We test for Price linkages of fish products on each market

Data

- The data used was obtained from the Ghana Statistical Service and made up of monthly fish prices per kilo from ten markets across the country from 2012 to 2015
- The markets are in Accra, Half Assini, Techiman, Mankesim, Agbozume, Kpando Torkor, Ada, Cape Coast, Wa and Tema.
- a potential panel of 480 observations for each fish type but there were data gaps for Kpala and Mackerel for some markets.

Methodology - both descriptive Statistics and Econometric analyses

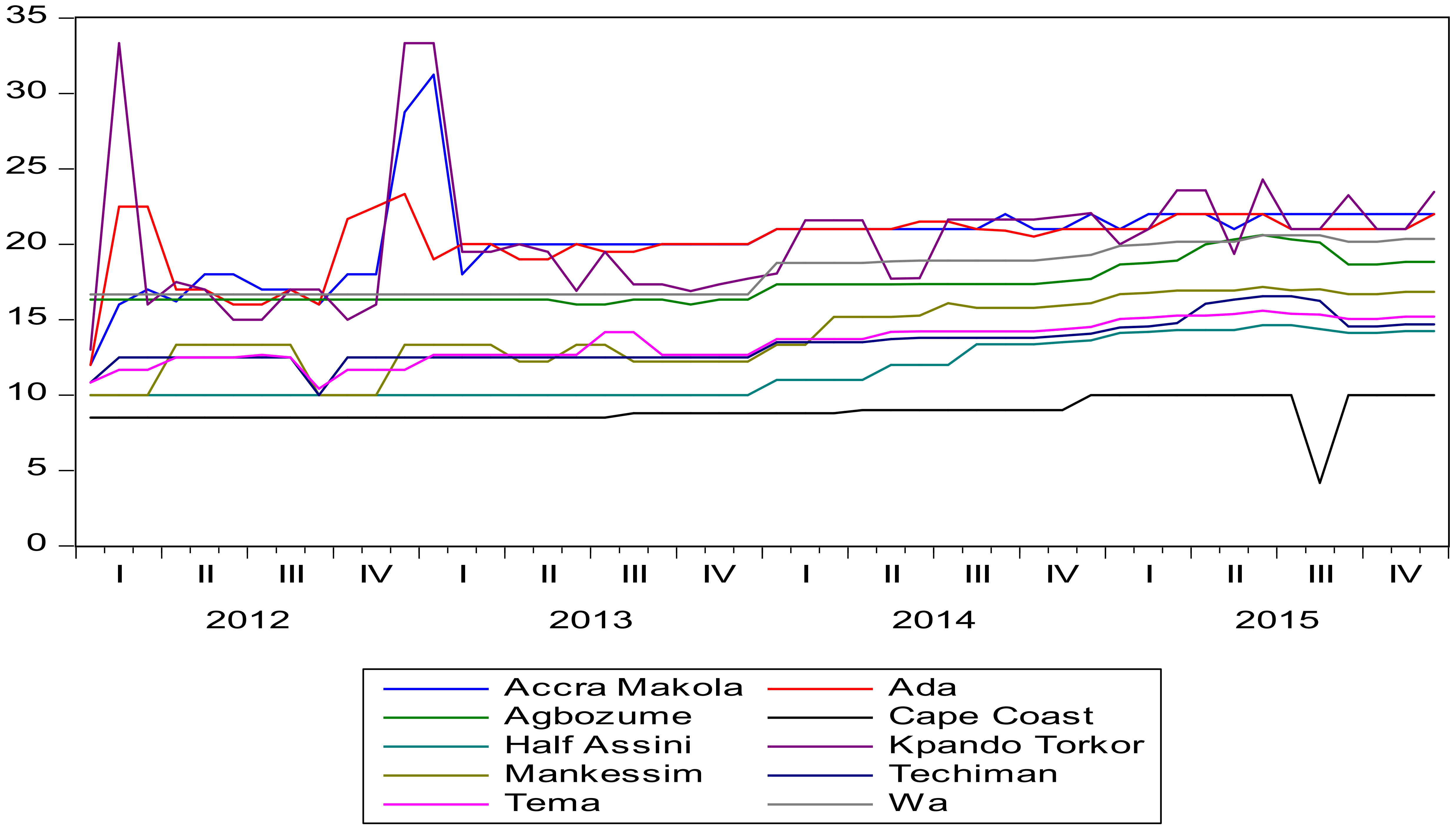
- Seasonality is addressed in various ways in the literature.
- The ratio to moving average method was used. Omar and others(2014)
- Kavussanos and Alizadeh-M (2002) with ε_t assumed as a well-behaved error term which capture irregular variations in the data and β_i as monthly coefficients.
- $\Delta Y_t = \sum_{i=1}^{12} \beta_i D_{it} + \varepsilon_t$ (1)
- Statistically significant β_is' were taken as indicative of seasonality.

Methodology

- AR (p) autoregressive models of order p with
- Moving Average Process of order q model, MA(q)
- ARMA(p,q) models
- Last four were applied by Floros and Failler (2004) with similar results
- We have applied it to the entire panel of fish product prices across market locations (the market index is j with j = 1, …,10.)
- $\Delta Y_{jt} = \sum_{i=1}^{12} \beta_i D_{it} + \varepsilon_{jt}$ (2)

Methodology- The Cointegration Test

- The time series properties of each fish price series was examined, particularly to ascertain if it was stationary or had unit roots. A stationary series behaves to return to its equilibrium time path when it experiences a shock.
- Studies by Mafimisebi (2008), FAO (2014), Brigante R. and A. Lem (2001) made use of the time series models for a particular fish product.
- Some studies currently use panel data methods to investigate cointegration for several time series of related commodities across units.
- The use of panel cointegration techniques helps us to test for the presence of long-run relationships among integrated variables with both a time-series dimension, T, and a cross-sectional dimension, N.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I
II
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I
II
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IV
2012
2013
2014
2015
Accra Makola
Ada
Agbozume
Cape Coast
Half Assini
Kpando Torkor
Mankessim
Techiman
Tema
Wa

VARIABLES	Tuna	Smoked River Fish	Sardines in Vegetable Oil	Dried Koobi	Smoked Herring
January	0.036***	0.082***	0.038*	0.024	0.067***
	(0.007)	(0.019)	(0.020)	(0.025)	(0.008)
February	0.007	0.041**	0.063***	0.063***	0.010
	(0.006)	(0.017)	(0.017)	(0.022)	(0.007)
March	0.003	-0.022	0.004	0.001	0.003
	(0.006)	(0.017)	(0.017)	(0.022)	(0.007)
April	0.002	0.014	0.022	0.007	0.021***
	(0.006)	(0.017)	(0.017)	(0.022)	(0.007)
May	0.009	0.016	0.003	-0.004	0.004
	(0.006)	(0.017)	(0.017)	(0.022)	(0.007)
June	0.011*	-0.001	0.011	0.007	0.005
	(0.006)	(0.017)	(0.017)	(0.022)	(0.007)
July	0.015**	0.030*	0.003	0.006	0.024***
	(0.006)	(0.017)	(0.017)	(0.022)	(0.007)
August	-0.002	-0.026	-0.007	-0.013	-0.009
	(0.006)	(0.017)	(0.017)	(0.022)	(0.007)
September	-0.030***	0.009	-0.019	0.012	-0.032***
	(0.006)	(0.017)	(0.017)	(0.022)	(0.007)
October	0.003	-0.007	-0.005	0.013	-0.002
	(0.006)	(0.017)	(0.017)	(0.022)	(0.007)
November	0.008	0.037**	0.014	0.007	0.013*

Seasonality

- The results, as shown in Table 2 and Table 3a, suggest significant seasonal peaks effects mostly for January and February for all fish types.

- In terms of the weather, January and February are part of the dry season in Ghana and other countries in West Africa. On the other hand, there were significant troughs for Tuna and dried herring prices in September

Table 3a: Peaks and Troughs in Fish Prices

Months / Fish Products	Tuna	Smoked River Fish	Sardines in Vegetable Oil	Dried Koobi	Smoked Herring
January	Peak	Peak	Peak	Weak positive effects	Peak
February	Weak positive effects	peak	peak	peak	Weak positive effects
March	Weak positive effects	weak negative effects	Weak positive effects	Weak positive effects	Weak positive effects
April	Weak positive effects	Weak positive effects	Weak positive effects	Weak positive effects	peak
May	Weak positive effects	Weak positive effects	Weak positive effects	weak negative effects	weak negative effects
June	peak	weak negative effects	Weak positive effects	Weak positive effects	Weak positive effects
July	peak	peak	Weak positive effects	Weak positive effects	peak
August	weak negative effects	weak negative effects	weak negative effects	weak negative effects	weak negative effects
September	trough	Weak positive effects	weak negative effects	Weak positive effects	trough
October	Weak positive effects	Weak positive effects	weak negative effects	Weak positive effects	weak negative effects
November	Weak positive effects	peak	Weak positive effects	Weak positive effects	peak
December	Weak positive	weak negative	Weak positive effects	peak	Weak positive

Table 3b: Main months of fish demand and supply situation

Fish supply and demand situation	Period/season	No. of fish traders/percent
Periods of highest fish supply	May to August;	188 (78.9)
Period of lowest fish supply	March to September;	157 (66.8)
Period of highest fish demand	August to October;	135 (56.7)
Period of lowest fish demand	February to April.	52 (51.8)

- fish prices across locations
- On a whole, only the price of smoked herring appeared stationary on levels at 5%, irrespective of the panel unit root tests method used.
- In contrast, the prices of Dried Koobi, Sardines, Smoked River fish and Tuna remained stationary at their first differences.
- there is the possibility that some fish prices may interact in the long run with a cointegrating relationship between two or more price series.

- Cointegration was done for only the fishes that were causally related. No cointegration was established.
- This implied that the observed causality between Dried Herring and Dried Koobi was a short run phenomenon (referring Table 6 shows this, with Max-Eigenvalues all being zero) when all market locations are considered over time.

- A panel causality test (Granger causality) was done to find out which fish types were related and show which one was likely to be endogenous across markets and over time in Ghana.
- A causal relationship was observed running from dried Herring to dried Koobi
- ***However no cointegration was established overall for the markets.***
- *This implied that the observed causality between Dried Herring and Dried Koobi maybe **a short run phenomenon** when all market locations are considered over time.*

- The discussion on seasonality and cointegration for the entire panel of data has been completed
- however there may be individual differences at different market locations which have been subsumed in the general result.
- Hence the analysis was continued at each market location where data was available.

Mankessim market

- Significant peak prices occur in January for prices of four fish products, namely, Herring, Kpala, Mackerel, and Tuna.
- April shows peak prices for Herring and Kpala.
- In June we have Sardines and Tuna with seasonal peaks.
- December has peaks for Koobi and Tuna.
- The foregoing analysis confirms that seasonality exists for in prices for all fish products whether imported (Sardines in oil) or not at Mankessim market

Mankessim market

- The Granger Causality test applied to the prices of products on Mankessim market (Table 8) and it was found that
- pairwise, Koobi and Herrings prices have a bidirectional relationship as have Tuna and Herring prices.
- Also evident was unilateral Granger causality from Sardines to Mackerel, Mackerel to Koobi, Kpala to River Fish, Kpala to Mackerel, Koobi to Tuna, Koobi to Kpala, finally Herring to Kpala.
- To analyse whether the causality identified may have both short run and long run attributes we applied a cointegration test.

Mankessim market

- The results shown in Table 9 mean that at least one cointegrating relationship exists between Tuna, Mackerel, Koobi and Herring prices.
- Thus unidirectional causal relationships between prices of Sardines to Mackerel, Kpala to River Fish, Kpala to Mackerel maybe be short run or transient.
- In contrast there are short and long run price linkages between Tuna, Mackerel, Koobi and Herring.

Techiman market

- Table 10b shows that seasonality exists in the prices for each fish product, with peaks in: January for Kpala, Mackerel, Sardines and River fish;
- July for Herrings, Kpala, Sardines and Tuna.
- Troughs in September for Koobi, Herrings, and Kpala.
- In terms of causality (Table 11), bidirectional links were found for Tuna and Sardines, Herrings and Mackerel. while unidirectional causality runs from Tuna to Kpala, Tuna to Herrings, Sardine to Herrings, River fish to Mackerel.

Implications?