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Article

Spatial equilibrium, market integration and price exogeneity in dry fish marketing in Nigeria: A vector auto-regressive (VAR) approach

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ABSTRACT

Fish is the cheapest animal protein source in Nigeria, and dry fish in particular has the potential to solve the pervasive protein shortage problem owing to its relative affordability compared with fresh fish. Boosting dry fish consumption will entail retail price reduction which is achievable only if the market for dry fish operates efficiently. This study, after testing and correcting price series for non-stationarity, modelled marketing efficiency in 66 pairs of spatially separated markets. The unit root test was used to reveal the order of econometric integration of the price series. All price series showed non-stationarity at their levels (P<0.05), but on first-differencing, they all rejected the null hypothesis of non-stationarity. This confirmed that they were generated by the same stochastic processes and, thus, capable of exhibiting long-run spatial equilibrium. The vector auto-regressive test showed that 59.1% of the markets had prices which were spatially integrated on the long-run. The Granger-causality model revealed that prices in Bauchi, Akure, Makurdi and Kano markets were driving prices in other locations. Kano market exhibited very strong exogeneity while others were either strongly or weakly exogenous. It is concluded that there is low extent of spatial pricing efficiency in Nigeria's dry fish market. The study recommended improved market infrastructures, improved information collection, collation and dissemination, and decisive policy reforms aimed at lowering retail price at the identified leader markets, as ways of enhancing spatial pricing efficiency.

Equilibrio espacial, integración de mercado y origen externo de los precios en el comercio de pescado seco en Nigeria: una aproximación mediante vector autorregresivo (VAR)

RESUMEN

El pescado es la fuente de proteína animal más barata en Nigeria, y el pescado seco en particular tiene el potencial de resolver el problema de la generalizada carencia de proteínas, gracias a su relativa asequibilidad respecto al pescado fresco. Potenciar el consumo de pescado seco conllevará una reducción del precio minorista, lo que solo se puede lograr si el mercado de pescado seco opera eficientemente. Tras probar y corregir la serie de precios eliminando la estacionalidad, este estudio modeliza la eficiencia del mercado en 66 pares de mercados separados en el espacio. Se ha utilizado la prueba de raíz unitaria para descubrir el grado de integración econométrica de la serie de precios. Toda la serie de precios se mostró no estacional en cada nivel (p < 0,05), pero al estimador de primera diferencia todas rechazaron la hipótesis nula de ausencia de estacionalidad. Esto confirma que se generan por los mismos procesos estocásticos, por lo que pueden mostrar equilibrio espacial a largo plazo. La prueba de vector autorregresivo muestra que en el 59,1% de los mercados los precios están espacialmente integrados. El modelo de causalidad de Granger reveló que los precios en los mercados de Bauchi, Akure, Makurdi y Kano guían los precios en otras localidades. El mercado de Kano muestra fuerte exogeneidad, mientras que otros muestran tanto mucha como poca exogeneidad. Se concluye que la eficiencia de precios del mercado del pescado seco en Nigeria es de poco alcance. Para potenciar la eficiencia espacial de los precios, el estudio recomienda mejoras en las infraestructuras del mercado y en la captura, el tratamiento y la divulgación de datos, así como reformas políticas esenciales dirigidas a reducir los precios minoristas en los mercados de referencia identificados.

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1. Introduction and problem definition

As against the long-held doctrine that agricultural marketing is less important compared with physical transformation or production, economic scholars and development practitioners have in the last three to four decades paid considerable attention to studying agricultural marketing for a number of reasons. First is that if marketing channels were less complex, more goods will flow through them and reach more consumers at less cost. The second is that, as posited by Abbot (1967), it is vitally important to integrate the expansion of marketing functions with the expansion of production. This is necessary because distribution plays an indispensable role in economic development. Finally, market integration plays a pervasive role in both agricultural and industrial development (Ravallion, 1986; Dittoh, 1994; Chirwa, 2001; Mafimisebi, 2001; Okoh & Egbon, 2003; Nielsen et al., 2006). This is owing to the fact that a well-linked market is that capable of facilitating optimum allocation of goods and resources.

The fact remains incontrovertible that nutrition is both an outcome of and input to national development in any country. This explains why policy makers and operators earmark considerable proportion of national resources to the food and nutritional needs of the masses of any country. Evidently, nutritional status depends among other factors, on access to food, which takes two dimensions; physical access and economic access. Physical access is synonymous with "availability' while economic access is interpreted to mean "affordability". While the latter is determined by income level or purchasing power, the former thrives on an efficiently operating distributive/marketing system. The requirement that the distributive system functions with a high degree of efficiency is important especially in third world countries where majority of the citizens live below the poverty line and food expenditures account for up to 80% of household's monthly expenditure. Owing to this situation, consumption of high-value foods is rare because people merely 'eat' to survive and bother less about feeding to nourish the body and live a healthy live. The high-value foods are costly compared with carbo-hydrate-rich diets. This necessitates an examination of high-value foods for their extent of marketing efficiency to reveal areas of possible savings in cost.

The level of animal protein consumption per caput per day in Nigeria is estimated at 7.0 g compared with the recommended 35.0 g. Shaib et al. (1997) reported a figure of as low as 3.25 g per head per day for people in the poor socio-economic class. Judged by the importance of animal protein in human's physical, physiological and mental development, the low consumption of animal protein has been a source of worry to nutritionists, policy makers and operators in Nigeria.

In Nigeria, fish is the cheapest animal protein source. Dry fish, in particular, is regarded as possessing the potential to solve the pervasive protein malnutrition problem in the country because of its relative affordability compared with fresh fish. Thus, dry fish seems to be the hope of the poor for increasing their consumption of animal proteins. Boosting the level of dry fish consumption will necessarily entail retail price reduction which is achievable only if the market operates efficiently. Since inefficiency in a marketing system at both intra- and inter- market levels is capable of jacking up delivered price, examining the Nigerian dry fish market for its extent of spatial pricing efficiency is crucial to achieving remunerative prices for producers and other market intermediaries and rendering retail prices affordable by final consumers. This is a desideratum for sustaining production and enhancing nutritional well-being of the populace.

The ability of a marketing system to efficiently carry out its function of contributing positively to the development of a country depends on the ease with which price changes and responses are transmitted spatially and temporally between markets for a homogeneous commodity. Owing to unavailability of data on transactions cost or low quality of such data in developing countries, synchronous price movement overtime has been accepted as a proxy for assessing marketing efficiency. A marketing system in which synchronous movement of prices is observed among spatially dispersed markets is considered as being integrated and market integration enhances efficient allocation of productive resources, static agricultural efficiency, short-term food price stability and long-term growth (Baulch, 1995).

The major objective of this paper is to assess the Nigerian dry fish market for presence and extent of long-run spatial equilibrium at the retail market level. The specific objectives are to; i) determine the extent of variability in retail prices; ii) test for the presence and degree of long-run spatial pricing efficiency and iii) identify markets exhibiting exogeneity in price formation and transmission.

2. Theoretical framework

Tests of market integration seek to measure the extent to which prices in different markets are inter-related. Although three forms of market integration are often distinguished, spatial integration has received most of the attention in the agricultural marketing literature.

Market integration studies are executed based on information on prices, with the analyses usually restricted to nominal prices for a homogeneous commodity in geographically dispersed markets. Tests of markets integration have become, therefore, attempts to assess the statistical association between two time series. There are five main approaches employed for testing market integration. These, in roughly chronological order of their first use in the literature are: correlation analysis, the law of one price (LOP), the Granger-causality approach, the Ravallion model and co-integration (Baulch, 1995). Alexander and Wyeth (1994), Baulch (1997) and Mafimisebi (2001) had done in-depth documentation of the step-by-step procedure involved in each of the aforementioned test approaches.

In understanding these approaches for testing market integration, it is germane to distinguish between three possible meanings of the word "integrated". The first is a statistical one and reference is to the stationarity of a univariate time series. A series is integrated of order one, or I(1), if it is not stationary in levels but stationary after first-differencing or logarithmic transformation or both depending on the cause of non-stationarity. Time series with common trend often turn out to be I(1). The second meaning of the word "integrated" is also statistical, but carries econometric over-tones. Two (or more) spatial time series are said to be "co-integrated" or exhibit long-run equilibrium, if they are both non-stationary individually but a linear combination exists between them which is stationary. That is, if $Xt \sim I(P)$ and $Yt \sim I(P)$, their linear combination should be integrated of order $I(P-I)$. In most instances, it is generally agreed that if the spatial price series are statistically integrated, then the market from which they emanate are economically integrated. Similar associations are made between market integration and the statistical co-movement of prices in the long run (Baulch, 1995).The third meaning of integration is an economic one based on arbitrage conditions. Two markets are integrated if whenever trade takes place between them, the price differentials for a homogeneous commodity equal transactions costs i.e

$$P^i_t + K^{ij}_t = P^j_t \tag{1}$$

When the same markets do not trade, price differentials for the commodity must be less than transaction costs. i.e

$$P^i_t + K^{ij}_t \neq P^j_t \tag{2}$$