THE EFFECTS OF MARKETING INFRASTRUCTURE ON INFORMAL CROSS-BORDER FOOD TRADE: A CROSS-SECTIONAL CASE STUDY OF GHANA

By

D.B. Sarpong and V.K. Nyanteng

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ABSTRACT

Promotion of cross-border food trade among the countries in the Central West African sub-region is underscored by the recognition that food security can be achieved and sustained through sub-regional collaborative effort. The promotion of cross-border trade however, depends on the support systems involving transportation, storage, processing, credit, market information systems, regulations and markets — places and installations, among others. This underpins the fact that market infrastructure plays a significant role in market integration. In this paper, the effects of marketing infrastructure on volume of cross-border food trade are investigated. The focus is on Ghana’s informal cross-border trade in the volume delivered of processed fish (Denu to Lome), maize (Kumasi to Niamey) and fresh tomato (Toubodom to Ouagadougou) using cross-sectional data from traders. The results indicate that storage, availability of transport and market price information (reflective in the purchase price) are statistically important in explaining peak season volume delivery in informal cross-border food trade commodities.

* Lecturer, Department of Agricultural Economics, University of Ghana (UG), Legon
** Senior Research Fellow, Institute of Statistical, Social and Economic Research, UG, Legon.
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1.0 INTRODUCTION

A reduction in persistent food shortages in several areas in the Central-West African countries of Togo, Mali, Niger, Ghana and Burkina Faso in the midst of abundance in other areas, would require policy makers to encourage food commodity flows across national borders. For example trade (formal and informal) between Ghana and Togo is particularly important during the lean season with respect to maize as food commodity. The need to promote cross-border food trade among the countries in the Central West African sub-region is underscored by the recognition that food security can fully be achieved and sustained through sub-regional collaborative efforts than efforts made by individual countries in isolation. It can be argued that trade as a vital element in the food system has a great potential to improve food security at household, national, international and sub-regional levels.

Beyond food security, cross-border food trade would also lead to poverty reduction among farmers in particular. The price structure of food commodities characterized by seasonality has resulted in price differentiation during peak and lean-season periods. Consequently, farm incomes tend to fall drastically during peak periods when prices of food commodities fall significantly. Therefore, the existence of market infrastructure such as storage and processing facilities could help in the storage of surplus foods during glut periods to leverage farm incomes. Moreover, cross-border food trade would lead to economic integration through the integration of markets (Lutz, van Tilburg and Van der Kamp, 1995). When price integration is achieved, long-term investments are harnessed as proper planning could be undertaken and inflation curbed. Additionally, cross-border food trade also generates substantial amount of foreign exchange for a country that helps to improve the balance of payment position of the country. Achello-Ogutu and Echessah (1998) summarize the importance of informal cross-border trade as…”stabilizes food availability by improving the supply through importation and increased production through export. It provides employment and hence incomes as most of the informal traders are not gainfully employed in the formal sector where opportunities continue to dwindle. Cross-border trade also complement formal trade in the agricultural marketing system and enhances efficiency in marketing by providing competition to the official trade".
Simuyemba (2000) in discussing trade and investment, however, points to Africa’s historical trade patterns as limited by its infrastructure development. Africa’s trade has been outward looking rather than inward looking, rooted in the pattern of colonial exploitation, homogeneity of production and trading of primary commodities. For example, the position of Ghana-ECOWAS general trade has been relatively more towards the rest of the world (USA, UK, Germany) for Ghana than to other West African countries for the period 1970-1995 (See Table 1). Trade with the ECOWAS countries particularly imports, increased as a result of the trade liberalization policies embarked upon since 1983 in Ghana. Particularly in 1985, Ghana’s import of crude oil from Nigeria was high reflecting in the higher input shares in her ECOWAS trade.

### TABLE 1: PATTERN OF GHANA’S TRADE FLOW: EXPORT AND IMPORT SHARES WITH MAJOR TRADING PARTNERS, 1971-1994 (PERCENTAGE)

<table>
<thead>
<tr>
<th></th>
<th>UK</th>
<th></th>
<th>USA</th>
<th></th>
<th>Japan</th>
<th></th>
<th>ECOWAS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXP</td>
<td>IMP</td>
<td>EXP</td>
<td>IMP</td>
<td>EXP</td>
<td>IMP</td>
<td>EXP</td>
</tr>
<tr>
<td>1971</td>
<td>23.81</td>
<td>24.82</td>
<td>10.23</td>
<td>12.48</td>
<td>22.21</td>
<td>15.00</td>
<td>8.10</td>
</tr>
<tr>
<td>1975</td>
<td>14.51</td>
<td>15.03</td>
<td>8.25</td>
<td>11.38</td>
<td>12.75</td>
<td>16.14</td>
<td>7.15</td>
</tr>
<tr>
<td>1980</td>
<td>17.57</td>
<td>21.42</td>
<td>10.78</td>
<td>12.15</td>
<td>15.49</td>
<td>13.20</td>
<td>9.00</td>
</tr>
<tr>
<td>1985</td>
<td>20.30</td>
<td>29.80</td>
<td>6.06</td>
<td>13.57</td>
<td>8.19</td>
<td>6.85</td>
<td>9.69</td>
</tr>
</tbody>
</table>

**Notes:** ECOWAS = Economic Community of West African States. Data excludes Ghana. Ghana is dependent on oil imports from Nigeria which accounts for a large share in her import trade over the period. Source: Sarpong (1997a)

However, a key component of market integration is the degree of price integration among markets, which is dependent on competition, road condition and distance, physical barriers, among others. This underpins the fact that market infrastructure plays a significant role in market integration. Goletti, Almed and Fariad (1994) identified market infrastructure as an important factor that influence market integration.

### 1.2 Problem Statement

The provision and installation of general infrastructural facilities in Ghana has increased over the last two decades. Antle (1983) has noted the strong relation between transportation and
communication infrastructure to aggregate agricultural (economic) productivity. However, issues concerning the effects of the availability and nature of marketing infrastructure on food trade in Ghana have received very little rigorous empirical analysis. Many studies have shown that poor road condition in the sub-region increases marketing costs considerably (see Asante and Kruse, 1995). In other studies, market information system is inadequate in terms of coverage, timing, dissemination and cost effectiveness and hampers the functioning of markets (Dittoo, 1994; Bassolet and Lutz, 1999). Transport, storage and processing facilities in Ghana are either malfunctioning or inadequate to address the current trends in marketing of agricultural commodities in a dynamic overly competitive economy. Furthermore, poor communication, social infrastructure and unavailability of appropriate vehicles to carry food commodities from the hinterlands to the consuming centres have resulted in spatial mark up prices (Ewusi 1971). Sarpong and Asante (2002) argues that the poor quality of roads, especially in the rural areas, is compounded by the inadequacy of appropriate vehicles for passenger and food commodities conveyance. Fosu (2001) focuses on petroleum price effects on food security whilst Ewusi (1971) concerned himself with the effects of road transport facilities on local food prices.

The determinants of cross-border trade are diverse and include trade and economic policies, climate and cropping patterns, infrastructure and cost of transport, production and consumption structure and comparative advantage considerations (Achello-Ogutu and Echessah, 1998). Whilst the importance of infrastructure to economic development has been highlighted in several studies, few, if any, have concerned itself with infrastructure effect on flow of goods in cross-border trade. For instance, the problem of distance, condition of road infrastructure and costs of transport, among others, can affect cross-border trade. In Ghana, such studies are scanty. Given two decades of economic transformation in Ghana and the need to encourage trade among the sub-regional economies, the magnitudes in the effects of infrastructure on Ghana’s trade, particularly with her neighbors, needs to be assessed. Consequently the paper concerns itself with analyzing the effect of the marketing infrastructure on the volume (flow of goods) of the informal cross border food trade from Ghana in peak seasons using cross-sectional market data.
The issues raised and addressed by this paper are: What are the magnitudes in the effect of the marketing infrastructure on peak season volume of informal food traded across borders from Ghana? What policies on marketing infrastructure can be implemented to enhance food trade flow across borders from Ghana?

1.3 Objectives of the Study
The primary objective of the paper is to estimate and analyze the magnitudes of the effect of marketing infrastructure on informal cross-border food trade in the Ghanaian situation using cross-sectional data.

The secondary objectives are:
1. To describe trends in the availability of the marketing infrastructure in Ghana for cross border food trade.
2. To estimate and analyze the magnitudes of the effect of components of marketing infrastructure on peak season volume of food commodities delivered in informal cross border trade of perishables (tomato) and semi-perishables (processed fish and maize).
3. To make policy recommendations that would enhance food trade across borders from Ghana.

The paper is structured into five sections. The next section reviews literature pertinent to the effects of marketing infrastructure. Section three discusses the methods for the analysis of the effects of the marketing infrastructure on informal cross-border food trade. Section four is the analysis of the estimated equations and discussion. Section five presents the conclusions, implications and policy recommendations arising from the study.

2.0 LITERATURE REVIEW
Marketing infrastructure can be defined as the entire support system that facilitates food trade and affects transaction costs of commodities. Succinctly, the support system involves transportation, storage, processing, credit, market information systems, regulations and market - places and installations (SADAOC document-1998). To Goletti and Christina-Tsigas (1995) marketing infrastructure is the set of transportation, communication, and credit and storage facilities that allow a smooth and reliable functioning of markets. These definitions
clearly point to marketing infrastructure as pivotal to the efficient and effective performance of markets and to food trade in particular.

There is significant documentation of the effects of infrastructure. Canning and Bennathan (undated) examined the contribution of infrastructure to output per worker by utilizing a production function for multi-country study. Infrastructure enters as a normal factor of production. They indicate that paved roads and electricity generating capacity have rates of returns at par with other forms of capital. Canning (1999) estimates the elasticity of output with respect to telephone stocks of around 0.14 and indicates that there is a large externality to telecommunication infrastructure but no significant impact of electricity generating capacity or transport infrastructure of a panel of annual cross country data, 1960-1990. Fay (undated) shows that the strength of association between income and infrastructure services varies across sectors. In Latin America, income per capita is most strongly associated with electricity services followed by telecommunication. Jacoby (1998) using non-parametric analysis indicates that the provision of extensive road access to markets infer substantial benefits to poor households. Songco (2002) provides a survey of the existing literature on the evidence on linkages between rural infrastructure investment (rural electrification, rural road improvement, rural water projects, etc) and household welfare such as health, education and capacity building.

In addition, the importance of infrastructural provision to economic development has been highlighted in several other studies (Auerbach, 1990; Duffy-Deno and Eberts, 1991). In Mexico, Feltenstein and Ha (1995) estimated the relationship between the provision of public infrastructure and private output. They concluded that infrastructure in electricity and communications generally reduces the cost of sectoral production but transportation infrastructure tended to increase costs of sectoral production. Antle (1983) has noted the strong relation between transportation and communication infrastructure with aggregate agricultural productivity in both developed and less developed economies. The effects of market information systems facilitating food trade through the integration of markets have been documented by many researchers (Adelman, 1991, Dittoh, 1994; Bassolet and Lutz, 1999). Goetz (1992) demonstrates that better information significantly raises the probability of market participation of selling households in Africa.
The importance of marketing infrastructure to the flow of goods (food trade) in Ghana is explicitly reflective in the extent of its usage. In Ghana, road infrastructure (roads and road vehicles) accounts for about 95% of domestic freight haulage, 97% of domestic passenger traffic and accounts for a substantial proportion of marketing cost in agricultural trade (MOFA 1997, Sarpong and Asante 2002). Fosu (2001) demonstrates empirically a negative effect of petroleum (diesel) price on food security in Ghana. Ewusi (1971) analyzing the effects of road transport facilities on local food prices observed negative relations (although not statistically significant) of vehicles used in transporting goods and the retail prices of food commodities. Alderman (1991) points to information flows and to the role of risks in Ghana’s grain trade in enhancing price formation.

Various government policies have been initiated and implemented with primary objective of improving marketing infrastructure in Ghana. One of such policies brought the Ghana Highway Authority (GHA), the Department of Feeder Roads (DFR) and the Department of Urban Roads (DUR) into existence in 1974, 1981 and 1988, respectively. Specifically, the DFR was entrusted with the responsibility of planning, developing and maintaining feeder roads network in Ghana which constitutes about 56% of Ghana’s road network. Sarpong and Asante (2002) on marketing infrastructure, particularly food trade infrastructure, reviewed its availability, use and cost on food marketing systems in Ghana. The total feeder road density in Ghana is 14,400 Km while in the case of storage facilities the country has a total of 70,000 MT capacity for grains from a total of 22 silo sites and 37 warehouse sites. However, the storage and processing industries are yet to experience its full share of the impact of government policies.

Communication availability is measured by telephone density. Until recently, the establishment of the National Communications Authority (NCA) following the liberalization of the airwaves and the print media have also led to an increase in the number of telecommunication providers within the country. Its quantitative impact on flow of goods in cross-border trade (formal and informal) in Ghana has yet to be assessed.

Bank branch density has been used as a measure of credit facility accessibility. The depth in bank branch density could enhance trading activities including the flow of goods to cross-
border markets. In the late 1980s, the financial sector adjustment program (FINSAP) brought with it the financial adjustment policy that liberalised the financial sector. This resulted in the establishment of new financial institutions with the already existing ones opening more branches nationwide. By March 1992, there were 320 commercial and secondary bank branches in the country. In addition, there are over 130 Rural Banks and branches in Ghana, giving a population per banking office ratio of about 45 thousand to one (Sarpong, 1997b).

Various kinds of food commodities are traded (formally and informally) across the borders of Ghana. The commodities, which Ghana exports to the countries in the Central West African Sub-region, can be classified into several categories such as agricultural and non-agricultural commodities (Nyanteng 1999). Predominantly, the non-agricultural commodities exported to the Central West African sub-region include various household items, building materials, skin and hair care products, soap, vehicle spare parts and accessories, packaging materials, petroleum oils, pharmaceuticals products etc (SADAOC 1998). The agricultural commodities include farm, sea and forest products, such as food of all kinds, fish, salt, wood furniture, veneer, plywood, sawn timber, charcoal, wooden poles, among others (Nyanteng 1999).

Processed food commodities involved in both formal and informal cross-border trade include cereals, roots and tubers, plantains, fruits, vegetables, legumes (beans, pulses/nuts), edible oil, animal products, fish/sea food, cocoa products and condiments. The raw forms of these commodities are also exported as non-processed food commodities. By far, Togo, Burkina Faso, Mali and Cote d'Ivoire are the countries that are involved in cross- border trade with Ghana (Table 2). Although Mali does not share borders directly with Ghana, it trades substantially with Ghana within the sub region. In diversity and total volume of exports to the Central West African Sub-region, the most important formal trading partner of Ghana is the Republic of Togo, followed by Cote d'Ivoire, Burkina Faso and Mali in that order. Between 1996-1998, Ghana exported on the average, 502 commodities to Togo annually, 289 commodities to Cote d'Ivoire, 176 to Burkina Faso and 26 to Mali (Nyanteng 1999). In terms of volume, Ghana’s formal export of processed fish, pepper, maize, oil palm and rice to Togo constituted on the average 80.5%, 25%, 32%, 15% and 99% respectively of Ghana’s world exports of these commodities between the periods 1996-1998 ((Ministry of Trade and Industry, et al, 1996), cited in Nyanteng (1999)). With salt and maize as the major
commodities, Burkina Faso imports between 1996-1998 represented 45% and 5.2% of Ghana’s world exports for salt and maize. Furthermore, 74% of Ghana’s world export of wheat flour went to Cote d’Ivoire.

There are significant annual fluctuations in the volume of formal cross-border food trade between Ghana and her neighbors. These fluctuations could arise from a dearth in marketing infrastructure, among others, and give credence to the fact that marketing infrastructure significantly influence cross-border trade. Furthermore, government policies also influence the nature of marketing infrastructure in Ghana. For instance, trade related-policies such as the realignment of the country’s currency to the major international currencies and the establishment of private foreign exchange bureau system have significantly influenced both formal and informal cross-border food trade since its implementation in 1983.
Table 2: NUMBER OF ITEMS EXPORTED FROM GHANA TO CENTRAL WEST AFRICA SUB-REGION BY COUNTRY, 1996-1998

<table>
<thead>
<tr>
<th>EXPORTS</th>
<th>BURKINA FASO</th>
<th>COTE D'IVOIRE</th>
<th>MALI</th>
<th>TOGO</th>
</tr>
</thead>
<tbody>
<tr>
<td>All commodities (Total)</td>
<td>161</td>
<td>200</td>
<td>166</td>
<td>176</td>
</tr>
<tr>
<td>Agricultural commodities</td>
<td>24</td>
<td>26</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>Percent total exports</td>
<td>14.9</td>
<td>13.0</td>
<td>6.6</td>
<td>11.4</td>
</tr>
<tr>
<td>Food commodities</td>
<td>19</td>
<td>17</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>Percent of Agric. Cmdt*</td>
<td>79.2</td>
<td>65.4</td>
<td>45.5</td>
<td>70.0</td>
</tr>
<tr>
<td>Processed foods</td>
<td>8</td>
<td>11</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Percent of food Cmdt*</td>
<td>42.1</td>
<td>64.7</td>
<td>40.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Non-Processed Foods</td>
<td>11</td>
<td>6</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Percent of foods Cmdt*</td>
<td>57.9</td>
<td>35.3</td>
<td>60.0</td>
<td>50.0</td>
</tr>
</tbody>
</table>

Notes: Cmdt = commodities 3YA is 3-year average Agric. = Agricultural
3.0 METHODOLOGY

The study utilizes both secondary data (for the description of the market infrastructure) and primary data for the analyses of the effects of infrastructure on informal cross-border trade. In objective one, a description is made of the trends in the quantum of the various marketing infrastructures in Ghana.

In objective two, primary data from traders in Ghana involved in informal cross border trade between Ghana on one hand and Togo, Niger and Burkina Faso on the other, are analyzed. Specifically the effect of the infrastructure on volume (at peak season) of the commodities traded in maize (Niger trade), tomato (Burkina Faso trade) and processed fish (Togo trade) are analyzed. The choice of the commodities and routes for the analysis, particularly, are conditioned by the extensiveness of responses in the administered questionnaire and also to reflect the spectrum of the degree of perishability of the agricultural commodities involved in the informal cross-border trade.

3.1 Theoretical Framework

Informal cross-border food traders, as suppliers of food commodities to the border market, are assumed to be profit maximisers operating in a perfectly competitive market. They maximize profits subject to their transaction cost arising from the use of the marketing infrastructure of storage, transportation, credit and market information, among others. In the profit maximization framework, given that the second order conditions hold, the first order conditions could be solved for the supply function of the cross-border traders (Silberberg, 1990). The supply response model yield volume supplied to the cross-border market as dependent on commodity prices and user costs of the infrastructures encountered in the transaction process. Feltenstein and Ha (1995) use the cost minimization framework. They estimate an aggregate translog cost function, derived from a simple production function augmented by public infrastructure in the Mexican economy with total output, relative interest and wage rates and stocks of infrastructure (electricity, communication and transport) as arguments. Antle (1983) also utilized the Cobb-Douglas production function.

From the profit maximization behavior, summing across all traders involved in the informal cross-border trade, the following aggregate food trade supply function can be written:
\[ q_{ft} = q_{ft} (P_{ft}, P_{S}, P_{T}, P_{Cr}, P_{In}) \]  

(1)

where,

- \( q_{ft} \) is the volume in kilograms of food traders ship to the cross-border market,
- \( P_{ft} \) is the purchase price of the food commodity traded at the cross-border,
- \( P_{S} \) is the price of storage,
- \( P_{T} \) is the price of transportation,
- \( P_{Cr} \) is the price on credit (interest on loans),
- \( P_{In} \) is the price on information on market condition at the border trade, and

\[ \frac{\partial q_{ft}}{\partial P_{ft}} > 0, \quad \frac{\partial q_{ft}}{\partial P_{S}} < 0, \quad \frac{\partial q_{ft}}{\partial P_{T}} < 0, \quad \frac{\partial q_{ft}}{\partial P_{Cr}} < 0, \quad \frac{\partial q_{ft}}{\partial P_{In}} < 0. \]

The implications are that as user costs of the marketing infrastructure increase, implying increasing bottlenecks in the provision of these facilities, the volume (supply) of food commodities shipped to border area decrease, ceteris paribus.

Simuyemba (2000), however, argues that in road and rail transportation, the consumer may be less concerned about the monetary cost of the service than they may be of the potential economic cost of the service in terms of lack of reliability, predictability and lack of certainty on the security and condition of cargo on arrival. Thus, consumers are willing to pay a higher infrastructure price if this mitigates the risk of potential loss. It is worth noting, however, that the availability, condition of state and volume of these marketing infrastructures are reflective in the user charges.

3.2 Data for Analysis and the Empirical Model

The data for the analysis are obtained from administered questionnaire for cross-border traders of the Food Trade, Infrastructure and Food Security Research Project of SADAOC undertaken over August – September 1999 over several markets in Ghana. The structured questionnaire asked the traders to indicate the average volumes of the food commodities delivered in the peak season and the average selling price (purchase price at cross-border market), among others, at peak season. Volumes of maize, tomatoes and processed fish delivered at the informal cross-border market per month were measured as the number of maxibags (100 kg), crates (boxes of 52 kg) and maxi baskets (45kg) respectively. August-September coincides with the peak season in Ghana’s food production system.
From the questionnaire, data on prices of the various user charges of the infrastructure were not specifically collected. However qualitative data (proxy indicators) on availability, timeliness and accessibility of these marketing infrastructures were collected. For any particular commodity, data on storage involves whether trader uses (hired or owned) any type of storage facility in the course of the cross-border trade, the location, condition and capacity. Similarly, data on transportation (besides asking for the type of vehicle used) utilizes the traders’ perception on the timeliness and availability of this infrastructure (road transport). Data on credit and market information are also evaluated on the trader’s accessibility, type (price, government policy, road condition, supply situation, etc), adequacy and timeliness, among others, of these marketing infrastructures.

A characterization and summary of the responses of the survey of informal food traders operating from Ghana to Togo, Niger and Burkina Faso in processed fish, maize and tomato are made (Table 3).

**Table 3: Summary of Cross-Border Trade Responses on Market Infrastructure Availability and Accessibility.**

<table>
<thead>
<tr>
<th>COM' DITY</th>
<th>ROUTE: (FROM – TO)</th>
<th>NO. OF TRADERS IN SAMPLE</th>
<th>TRANSPORT</th>
<th>STORAGE</th>
<th>CREDIT</th>
<th>EXT. MKT PRICE INFO ACCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Availability</td>
<td>Timeliness</td>
<td>AVAILAB</td>
<td>ACCESS</td>
</tr>
<tr>
<td>MAIZE</td>
<td>KSI-NMY**</td>
<td>30</td>
<td>SOME</td>
<td>SOME</td>
<td>SOME</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>KSI-LOM</td>
<td>4</td>
<td>ALL</td>
<td>ALL</td>
<td>NONE</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>KSI-OUG</td>
<td>8</td>
<td>ALL</td>
<td>ALL</td>
<td>NONE</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>TMAN-LEO</td>
<td>20</td>
<td>ALL</td>
<td>ALL</td>
<td>SOME</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>TMAN-OUG</td>
<td>25</td>
<td>ALL</td>
<td>ALL</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>FISH</td>
<td>DN-LOM**</td>
<td>15</td>
<td>SOME</td>
<td>SOME</td>
<td>SOME</td>
<td>SOME</td>
</tr>
<tr>
<td></td>
<td>ADI-LOM</td>
<td>14</td>
<td>SOME</td>
<td>SOME</td>
<td>SOME</td>
<td>ALL</td>
</tr>
<tr>
<td>TOMATO</td>
<td>TUO-OUG**</td>
<td>20</td>
<td>SOME</td>
<td>SOME</td>
<td>NONE</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>ADA-LOM</td>
<td>17</td>
<td>ALL</td>
<td>ALL</td>
<td>NONE</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>TMAN-OUG</td>
<td>11</td>
<td>ALL</td>
<td>ALL</td>
<td>NONE</td>
<td>NA</td>
</tr>
</tbody>
</table>

KSI = KUMASI NMY = NIAMEY LOM = LOME OUG = OUAGADOUGOU TMAN = TECHIMAN DN = DENU
ADI = ADIDOME TUO = TUOBodom. NA – NO RESPONSE   ** Selected routes for empirical analysis

The characterization is in terms of the responses on transport availability and timeliness, whether they store the produce in the course of their trading activities and their accessibility to
credit and market information. From Table 3, the extent of availability of the market infrastructure to the maize, processed fish and tomato cross border traders vary. For instance, no variation in responses existed in the maize trade so far as the marketing infrastructures are concerned from Kumasi to Lome. On the other hand, responses in the maize trade from Kumasi to Niamey, processed fish trade from Denu to Lome and tomato trade from Tuobodom to Ouagadougou showed variations in the responses that allow the estimation of equations (2) and (5). The number of traders sampled in the survey between these destinations and commodities involved in the informal cross-border trade are shown in Table 3.

The form of data available imposed modifications and qualifications to the empirical model specified in equation (1). If the volume of supply of the traded commodities are affected by the types and quantities of the infrastructure available, via the production (supply) function, then the following empirical model can be structured using the information from the sample survey:

\[ q_{fti} = a_0 + b_1 S_i + b_2 T_{1i} + b_3 T_{2i} + b_4 C_{ri} + b_5 I_{ni} + b_6 P_{fti} + e_i \]  

(2)

Where \( q_{fti} \) is volume of food commodity shipments to the border at peak season per month and,

- \( P_{fti} \) is as previously defined,
- \( S_i \) is a dummy that takes on a value 1 when trader i has access to any storage facility and zero (0) otherwise;
- \( T_{1i} \) is a dummy on timeliness of the transportation to trader i, where Yes =1 and zero otherwise;
- \( T_{2i} \) is a dummy on availability of the transport and measured as in \( T_{1i} \);
- \( C_{ri} \) is trader i’s accessibility to credit sources and measured as a dummy for 1, when trader has access to external credit and zero otherwise;
- \( I_{ni} \) is a dummy on trader i’s access to information on the external market supply and demand conditions. A dummy 1 represents a Yes and zero otherwise, and
- \( e_i \) are error terms obeying all the assumptions underlying the classical linear regression model.
The a-priori expectations are therefore:
\[ \frac{\partial q_{ft}}{\partial P_{ft}}, > 0, \quad \frac{\partial q_{ft}}{\partial S}, > 0, \quad \frac{\partial q_{ft}}{\partial T}, > 0, \quad \frac{\partial q_{ft}}{\partial Cr}, > 0, \quad \frac{\partial q_{ft}}{\partial In}, > 0. \]

The null hypothesis \((H_0)\) is that \(b_i = 0\): the market infrastructures have no effect on the volume of food commodities traded across borders and the alternative hypothesis \((H_a)\) is that \(b_i > 0\): the market infrastructures has positive effects on the volume traded.

The estimated coefficients on the dummies are interpreted as (a) the percentage change in volume as a result of access to the market infrastructure if the dependent variable is measured in natural logarithm\(^1\), and (b) the expected difference in volume between those who have access to and those who do not of the infrastructures, if the dependent variable is not in natural logarithmic form.

**4.0 EMPIRICAL RESULTS AND DISCUSSION**

The available market infrastructure that affects cross border food trade in Ghana are described. Next, the estimated effects of these marketing infrastructures on the volume of cross border trade are presented.

**4.1 Availability of Market Infrastructure**

The condition of road transport is an important marketing infrastructure as far as cross border trade is concerned. The conditions of trunk and feeder road networks to the total road network in Ghana in 1997/98 are shown in figures 1 and 2.

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\(^1\) Baltagi (1998) indicate that the percentage change in volume due to the infrastructure dummies must be calculated as \(e^b-1\) where \(e\) is the base of the natural logarithm and \(b\) is the estimated coefficient on the dummy variable. See also Halvorsen and Palmquist (1980).
It is observed in Figure 1 that higher proportions of the trunk roads in Ghana are in poor condition. Only 19.4% of the total trunk road network are classified as good and as much as 55.9% are in poor condition. Figure 2 shows that greater proportions of the feeder roads are in good condition. By 1998, 51% of the total feeder road network were good and 13% were in poor conditions. In order to facilitate cross border food trade, it is expected that a greater
proportion of the good feeder roads must be linked to food producing areas. Further, the road density in Ghana is still very low representing only 14% of the required (MOFA, 1997). Although the total vehicles in the country increased by more than 143% between 1980-1998, cargo vehicles constituted less than 30 percent of the total number of registered automobiles (VELD files, 1995-1998). Rail freight traffic has declined overtime compared to road transport for agricultural commodities and inputs. There has been shortages of coaches and wagons and frequent derailments that has led to loss of productive time along the rail system, notwithstanding the fact that the bulk of the rail system links the mining centers in the south of the country (Min. of Roads and Highways, 1990).

Bulk storage facilities need repairs to be fully operational. By 1998, state silo sites numbered about 22 with storage capacity of about 16 thousand metric tonnes whilst warehouses were 37 with a total storage capacity of 35,030 metric tons. Processing facilities available are small-scale with large-scale processing facilities restricted to fruits and, to some extent, oil palm.

As at July 1998, 125 market places have been constructed in seven regions but they all lack the basic social amenities needed to standardize the markets. Institutional credit delivery to primary agriculture and agricultural related activities has been grossly inadequate. Market information is usually acquired informally as the high rate of illiteracy among traders restricts their use of formal information. These have implications on conveyance of food commodities in Ghana.

4.2 Regressions of the effects of the Market Infrastructure on flow of goods:
The estimated equations on effects of market infrastructure on the flow of agricultural commodities to the border markets (Equation (2)) are summarized below. Values in parentheses are the estimated t-statistics. Estimates marked with one, two or three asterisks (*) are significant at 10%, 5% and 1% levels, respectively.

_Processed Fish Market: Denu to Lome_

1. \[ \ln q_n = -2.730 + 1.363S_i + 0.542T_{1i} - 1.056T_{2i} + 0.704Cr_i + 1.179 \ln P_{ft} \]
   \[ \text{(0.374)} \quad \text{(1.582)} \quad \text{(0.914)} \quad \text{(1.836)} \quad \text{(1.148)} \quad \text{(0.809)} \]
   Sample Size = 13 \quad R^2 = 0.572 \quad \text{Adj. } R^2 = 0.305 \quad F = 2.141
2#. \( \ln q_{	ext{ft}} = -8.126 + 1.957 S_i - 1.080 T_{2i} + 2.288 \ln P_n \)
\( (1.339) \quad (2.664)** \quad (1.937)* \quad (1.913)* \)
Sample Size = 13 \( R^2 = 0.474 \) \( \text{Adj. } R^2 = 0.316 \) \( F = 3.006* \)

*Fresh Tomato: Tuobodom to Ouagadougou*

1. \( \ln q_{	ext{ft}} = 6.176 - 0.561 T_{1i} + 0.792 T_{2i} - 0.279 \ln P_{ft} \)
\( (1.551) \quad (1.343) \quad (1.790)* \quad (0.275) \)
Sample Size = 19 \( R^2 = 0.170 \) \( \text{Adj. } R^2 = 0.014 \) \( F = 1.089 \)

*Maize: Kumasi to Niamey*

1#. \( q_{	ext{ft}} = 69.887 + 3.255 P_{ft} \)
\( (0.291) \quad (1.915)* \)
Sample Size = 29 \( R^2 = 0.116 \) \( \text{Adj. } R^2 = 0.084 \) \( F = 3.669* \)

2. \( q_{	ext{ft}} = 89.251 + 26.192 S_i - 293.729 T_{2i} + 238.298 \ln + 3.154 P_{ft} \)
\( (0.235) \quad (0.114) \quad (0.741) \quad (0.906) \quad (1.743)* \)
Sample Size = 29 \( R^2 = 0.153 \) \( \text{Adj. } R^2 = 0.017 \) \( F = 1.126 \)

The estimated \( R^2 \) and adjusted \( R^2 \) that measures variations in the dependent variable explained by the independent variables are low. The F-statistic measures the overall significance of each of the models. The equations for discussion are selected on the basis of the significance of the estimated parameters and the overall F statistic.

### 4.3 Discussion of the estimated regression results

For processed fish, the effects of storage facilities and price are statistically significant in explaining the natural logarithm of the volume moved from Denu to Lome. Price and storage access effects on volume moved are positive and highly elastic. A percentage change in volume of processed fish moved from Denu to Lome as a result of access to storage and of the purchase price is 6.08 (\( e^{1.957} - 1 \)) and 2.28 respectively, holding other variables constant. The coefficient of availability of transport, on the other hand, has the wrong a-priori sign, is elastic, 1.95 (\( e^{1.080} - 1 \)) and significant at the 10 percent level.

In the fresh tomato trade, the availability of transport is critical in cross-border trade. The purchase price elasticity is negative although not statistically different from zero. This implies
perhaps a less responsiveness of tomato volume shipped to the cross-border market to purchase price of fresh tomato. Although the transport availability parameter is positive and significant, the overall model, measured by the F-statistic is not, indicating either omitted significant variables or mis-specification in the model.

In the maize trade, the marginal response of volume to price is 3.25, with a calculated elasticity of 12.27. As the purchase price goes up by a percentage point, the volume shipped at peak season increases for maize by about 12 percentage points, ceteris paribus.

To the extent that marketing information as an infrastructure is critical in the transmission of prices, the purchase price is statistically significant and elastic in the commodities traded of maize and processed fish. The implication is that the marketing infrastructures of storage, availability of transport and market price information (reflective in the purchase price) are statistically important in the volume traded in informal cross-border food trade.

Parameter estimates from previous research on effects of infrastructure on cross-border trade is scanty. However, in the realm of its impact on the integration of markets, several studies, as indicated in the literature, attest to market infrastructure of information, price and transport as effective in enhancing trade.

5.0 SUMMARY, IMPLICATIONS AND POLICY RECOMMENDATIONS

5.1 Summary
The paper investigated effects of marketing infrastructure on informal cross-border food trade. The focus was on Ghana’s informal cross-border trade in processed fish (Denu to Lome), maize (Kumasi to Niamey) and fresh tomatoes (Toubodom to Ouagadougou) using cross-sectional data from traders. The available national stocks of the selected marketing infrastructure indicate the need to accelerate the development and provision of these. The empirical results indicated that storage (fish trade), availability of transport (tomato trade) and market information (price) are significant in explaining volume traded of these commodities on the cross-border markets.
5.2 Implications of the study
Relative to the degree in perishability of the commodities studied, dry maize is less perishable relative to processed fish and fresh tomato in that order. The results of the analysis on volume effects of marketing infrastructures therefore have implications for food security. Firstly, in terms of volume effects, the relatively less perishable food commodities of maize and processed fish move on market prices when in season. The volumes moved are very responsive to changes in storage and price conditions. Deterioration in storage and road and road transport conditions will elicit larger than proportional volume effects in the informal cross-border trade. On the other hand, the most perishable commodity, tomato, moves on the availability of transport where early delivery is essential, and less dependent on the market price when in peak season. Secondly, in terms of volume, storage is less important in the tomato trade as a result of its relative high degree of perishability.

The results are reflective of the marketing of these produce in Ghana conditioned on the infrastructure facilities available. Tomato, in peak seasons, is particularly moved to the market (local and border) at the prevailing price, other factors held constant. Storage, over long periods, of fresh tomato in Ghanaian trading scene is still ill developed. A critical factor in fresh tomato movement to the market centers is predicated on the availability of transport. Unavailability of transport not only depresses farmers’ income, they could affect production decisions in the next season.

5.3 Policy recommendations
This study has identified the infrastructures of storage, transport and market information as being important in facilitating the informal cross-border trade in food from Ghana to the sub-region. The investment environment in infrastructure development is therefore paramount. Deriving from the analyses and conclusions, the following policy recommendations are made.

- Participants in the informal cross-border trade should be encouraged to invest in storage facilities. The government could support this through the provision of credit facilities by making access easier to credit facilities.
Access to market price information increases the volume transacted in the relatively storable products of maize and processed fish. Currently the Ministry of Food and Agriculture (MOFA) collects and disseminates this information. MOFA should liaise with her counterparts in the sub-region to ensure adequate provision of market information for use by cross-border traders.

Secondly, the availability, quantity and quality of transport are critical to trading in perishables. The availability of transport hinges on the condition of our roads and government policies that enable the importation of vehicles adapted to the haulage of perishable food commodities. Government should enhance the provision of good roads. In addition the importation of vehicles adapted to the haulage of perishable food commodities should attract low duty to encourage importation.

In general, government macroeconomic policy should provide incentives needed for private sector initiatives to provide the infrastructure needs to enhance cross border trade. Improved access to market infrastructure would not only increase the volume of commodity shipments to the borders, it would also increase participation of the private and public sectors in job creation thereby enhancing some aspects of food security.

The study, albeit limited, attempt into estimating the effects of marketing infrastructure on informal cross-border traders. Like many other studies, this study has limitations. First, the use of cross-sectional data allows only a snapshot measure of the effect of infrastructure. The sample size is also small for the cross-border traders. There is the need for time series data to analyses properly the effects of market infrastructure on cross-border trade. Secondly, the proxy indicators of market infrastructure may not be reflective of the user costs. Thirdly, the focus is on the effects of infrastructure on informal cross-border traders and not on differences between destinations across borders. This is as a result of the un-availability of parallel information (data) on informal cross-border trade flows from the other neighboring countries. An extension of this study involving trans-national informal cross-border trade data would enhance policy inferences.
LIST OF REFERENCES


