Expenditure on Fresh Vegetables, Fresh Fruits, and Peanut Products in Urban Ghana: Does Location Matter?

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Abstract

The study found that beside socioeconomic and demographic factors (including income, education, marital status, age, and household composition), the fresh vegetable, fresh fruit, and peanut product expenditure are affected by location in urbanized areas of Ghana, and the location interacts with income in determining the food expenditure.

Key words: Regional difference, ANOVA, Multivariate Tobit model, socioeconomic factors, and demographic factors.

1 Introduction

Safe and nutritious food is demanded for people to pursue a healthy and active life (FAO, 1996). It is well established that health benefits are closely associated with consumption of several specific foods such as fresh vegetables, fruits, and nuts. Vegetables and fruits are rich in a number of health-promoting nutrients and food compounds, including antioxidants such as vitamin C, and folate, potassium, phytochemicals, dietary fiber, and plant proteins (Steffen, 2006). Current scientific evidence also suggests a crucial role of fruit and vegetable consumption in prevention of a variety of chronic diseases, including cardiovascular diseases, hypertension, diabetes, and obesity (Duyn et al., 2000; Van't Veer et al., 2000; Van Bazzano, 2006; Low et al., 2007; Uusiku et al., 2010) Additionally, greater vegetable and fruit consumption has a protective effect in cancers of the stomach, esophagus, lung, oral cavity, pharynx, endometrium, pancreas, and colon (Steinmetz & Potter, 1996). Likewise, as an excellent source of multiple nutrients including vitamin E and magnesium, nuts play a crucial role in health protection and promotion (King et al., 2008). Because nuts (including peanuts, although it is a legume) are considered the dietary plants with the highest content of total antioxidants (Blomhoff et al., 2006) and unsaturated fatty acids, these healthy food compounds contribute significantly to the beneficial effects of frequent nut intake (Ros & Mataix, 2006). Moreover, studies have been consistent in showing an association between nut consumption and reducing the risk of cardiovascular and coronary heart disease (Mattes et al., 2008; Kris-Etherton, 2008; Sabaté & Ang, 2009). The role of nuts in reducing the risk of diabetes, obesity, and cancer has recently been identified as well (King et al., 2008).

Nowadays, the leading cause of death in the world (Yach et al., 2004) are chronic diseases that are not limited to developed countries, and have become increasingly prevalent in developing countries as well (Ruel et al., 2005). In Africa, more than 90% of patients with hemorrhagic stroke and more than half with ischaemic stroke are found to have high blood pressure (Mensah, 2008). Despite the remarkable and well documented effects of fresh vegetables and fruits on health, their consumptions is still far below the dietary recommendation level, especially in the developing world including many

African countries (WHO, 2004; USDA, 2004). For example, the WHO recommended consumption level of vegetable and fruits is 146 kg per year. However, in West African country such as Ghana, the vegetable and fruit consumption per capital was only 50.1 kg and 23.5 kg per year, respectively, in 1998 (Ruel et al., 2005). In contrast to the overall low fresh vegetables and fruits intake, high consumption and eating frequency characterizes peanut products, an integral component of the diet especially in sub-Sahara area. National per capita peanut consumption was about 0.61 kg per week in Ghana (Awuah. 2000), and 80 percent of Ghanaians eat peanut products weekly or more often (Jolly et al., 2008). Regular consumption of peanuts is found to lower the total cholesterol and triacylglycerol concentration among health Ghanaians (Lokko et al., 2007). However, peanuts are often contaminated with aflatoxin due to poor storage conditions (Awuah et al. 2009), and presence of aflatoxin may contribute to cancer and other health problems (Groopman et al., 1996).

Therefore, in recent year, studies on the consumption of these health protective foods are increasingly demanded to guide policy makers in formulating the health-promoting programs. Also, food producers/marketers need researches to identify target consumer groups of these particular food items. Currently, decades of research explore patterns and trends of vegetable and fruit consumption in relation to socioeconomic groups for decades (Hall et al., 2009). Factors that affect fruit and vegetable consumption include sensory appeal, familiarity and habit, cost, availability, media influence, and others (Pollard et al., 2002), while, the familiarity and habit can be captured by socio-demographic characteristics including income, household size and composition, gender, and education (Ruel et al. 2005). Likewise, the crucial role of peanuts, an important source of protein and fat, on health has been recently documented, and a number of studies have investigated peanut products consumption in a wide range. For example, Jolly et al. (2008) investigated the frequency of peanuts consumed and evaluated the factors influencing consumers' eating decisions. Awuah et al. (2009) focused on the factors influencing the peanut products sorting along market chain, and Florkowski and Kolavalli (2013) examined the quality of peanut products in relation to aflatoxin contamination in Ghana.

Previous studies explore the specific food consumption comprehensively. However, the crucial effect of household location on food consumption was often underrated. Although the regional difference in food consumption is consistently confirmed (Wetherbee, 2004; Ruel et al., 2005) especially in terms of the urban-rural difference (Smith et al., 2005; Van de Poel et al., 2007; Fotso, 2007). Earlier studies did not quantify the location effect beyond the urban-rural gap in Africa, and did not examine how the location interacted with other factors in determining the food consumption. Additionally, although in traditional sub-Saharan African diet, peanuts and peanut-based products are often complement vegetables and fruits in main dishes or snacks, few of studies explore peanut product consumption together with fresh vegetables and fruits.

By 2030, two-thirds of the world's population will live in cities, and nearly all of this growth takes place in developing countries. Many cities in Africa will double in size over the next 15 to 20 years (World Bank, 2013). Vegetable and fruit consumption has grown at a faster rate in most urban centers of the developing world than in rural area (Hertel & Hertel, 1999). In sub-Saharan Africa, besides the urban-rural differences, interregional disparities are serious (Konadu-Agyemang, 2000). In Ghana, the southern part of the country has a much faster economic growth than the northern part (Grant & Nijman, 2004) Therefore, exploring how the food expenditure varies with the location is increasingly relevant, especially among households in fast growing urban areas. Therefore, our study fills the gap by examining how location affects food expenditure on fresh vegetable, fresh fruits, and peanut products using a survey data collected from urban households of Ghana in 2011. The current study addresses two major issues: a) it investigates how the expenditure on fresh vegetables, fresh fruits, and peanut products varies by location; b) it provides insights about the determinants of expenditure on these specific foods, considering the difference in household location.

The current study provides a comprehensive understanding of the determinants of the special food expenditure (i.e., fresh vegetable, fresh fruit, and peanut products) in urban household of a West Africa country, Ghana. Results confirm that both fresh vegetable

and peanut products consumption change significantly with location, and furthermore, the location factor also interacts with income. But the finding is not significant in case of fresh fruit expenditure.

The study also provides valuable insights to private sector in formulating national or regional marketing strategy. Food retailers are suggested to promote their fresh vegetables and fruits to the high-income, well-educated households of married consumers in southern areas of Ghana, while target their peanut products sale to large educated households in the noncapital cities. Increasing consumption of foods with highly desirable nutrients such as vegetables and fruits is a practical and sustainable way to alleviate micronutrient deficiency. Understanding of location difference and consumer profile helps policymakers to facilitate community and local programs to increase fresh vegetables and fruits consumption, while results in relation to peanut product consumption shed light on peanut-based product contamination risk by identifying the areas and households with high peanut product consumption.

2 Conceptual Frameworks

The study applies concepts from the consumer demand theory and the Engel curve specification. Within the budget constraint, households decide the optimal levels of their food and nonfood consumption that maximize their utility level (Equation 1). Here, the food products include fresh vegetables, fresh fruits, peanut products, as well as other food items;

$$\text{Max } U=U(q_v, q_f, q_p, q) \quad (1)$$

$$\text{s.t. } PQ=I \quad (2).$$

In Equation 1, U is the household utility, q_v is fresh vegetable consumption, q_f is fresh fruit consumption, q_p is peanut product consumption, q is household consumption of other food items as well as all other non-food products. Equation 2 states the budget constraint, where P is a price index vector for fresh vegetables, fresh fruits, peanut products, and all other goods, Q is the corresponding consumption vector containing all the consumption variables mentioned as elements, and I is a scalar indicating household income. It is noted that the price index of all other goods is normalized and equals one for convenience of

comparison. After solving for the Lagrange, the optimal food consumption of fresh vegetables, fresh fruits, and peanuts products is found to be a function of price index, household income, and household preferences (Equation 3):

$$q^*=q(P, I, k) \quad (3)$$

where q* is the optimal food consumption vector, and k is the household preference parameter defining the particular utility functional form. Although household preferences are often not observed, it can be shaped and captured by socio-economic factors such as education and occupation, as well as demographic characteristics including household composition, gender, age, and location (Ruel et al., 2005). After controlling for the regional price difference, it is reasonable to assume stable price in cross-section data. Therefore, given the constant price assumption, the food expenditures, the product of food consumption and the corresponding price, depend on household income, socioeconomic factors, and demographic factors including location. Here, location factors may relate with other determinant variables in affecting food expenditures. The close relation between the consumption of specific goods and income has been well documented by Engel curve (Wetzstein. 2013). Food is a normal good, so its consumption is expected to increase with income. Studies are remarkablely consistent in supporting fresh vegetables, fresh fruits, and peanut product consumption are influenced by socio-demographic factors (Ruel et al., 2005; Hall et al. 2009; Jolly et al., 2008).

3 Data

The present study uses the survey data collected in three big cities of Ghana (i.e., Accra, Takoradi, and Tamale) in 2011. Accra is the capital of Ghana, Takoradi is an important port and the fourth largest city, and Tamale is the capital city of Nortern Region. Both Accra and Takoradi are located in South, while Tamale is in North. According to the questionnaire, the respondents were asked about their food shopping habits, food spending, and other information such as age, gender, occupation, household income, and household composition. Among the food spending questions, they are require to share their weekly spending on fresh vegetables, fresh fruits, as well as peanut products. Here peanut products include peanut paste, butter, and other peanut-based products.

After deleting incomplete records, 1,010 observations were employed in the data analysis. Table 1 shows the definition and units of variables included in the empirical analysis, and some descriptive statistics such as mean and standard deviation. In the presenting sample, 60.6 percent are from Accra, 20.8 percent from Takoradi, and the remaining 18.6 percent from Tamale. Results indicate that a typical urban household in Ghana spent 13.0 cedi on fresh vegetables, 5.4 cedi on fresh fruits, and 3.3 cedi on peanut products respectively. Among the survey households, three out of four were married households, and the average age is 39.2 years old. Additionally, on average, there are about one teenager household member (between 4 to 12 years old), two adult members (between 19 to 60 years old), as well as 0.15 elder members (above 61 years old). Moreover, the mean of household income in the month preceding the survey was 646.1 cedi. Among the respondents, 64.2 percent were reported as self-employed, 24.3 percent government or civil employee, and 11.5 percent not employed, students, or the retired. In terms of their education level, more than half of the respondents have a high-than-high-school education.

Moreover, the weekly household food expenditure on fresh vegetables, fresh fruits, and peanut products in the three cities above are showed in Table 2. Weekly household expenditures on fresh vegetables are 14.4, 11.1, and 9.7 cedi respectively in Accra, Takoradi, and Tamale, on fresh fruits are 5.7, 5.2, and 4.2 cedi, and on peanut products are 2.7, 3.5, and 4.9 cedi. Comparing with Tamale, households in Accra and Takoradi have higher food expenditure on fresh vegetables and fruits but lower peanut products expenditure.

4 Empirical model

Within the conceptual framework above, both ANOVA analysis and SUR-Tobit model were employed in order to fully test and examine the effect of location on fresh vegetables, fresh fruits, and peanut products consumption.

First, analysis of variance (ANOVA) was use to statistically test whether the location difference in the weekly household expenditure of each food category is statistically

significant. ANOVA is used to determine whether there are any significant differences between the means of three or more independent groups (Laerd. 2013), and this method was applied broadly in economics, statistics, business, public health, and medicine (Neter et al., 1996). Here, in the present study, the hypothesis to be test is that the means of weekly specific food expenditure are the same in Accra, Takoradi, and Tamale (Equation 4):

$$H_0^i:\ u^i_{\text{Accra}} = u^i_{\text{Takoradi}} = u^i_{\text{Tamale}} \qquad (4)$$

where u is the mean of weekly food expenditure, and i denates each food category. Therefore, the means of fresh vegetables, fresh fruits, and peanut products expenditure are tested separately.

Second, Motivariate Tobit model (MV-Tobit model) were combined to examine how the location affects the food expenditure after controlling the key socio-demographic variables. The household food expenditures are censored at zero, namely, 1.21% zero expenditure in fresh vegetables, 7.53% in fresh fruits, and 6.41% in peanut products. Thus, in each equation of one food category, Tobit model is suitable to deal with the censored food expenditure (Green. 2003). Also, since the household expenditure on these three food items may related with each other, the potential cross-equation correlation need to be addressed by an equation system in order to obtain efficient results (Barslund. 2009). In each equation, the weekly household expenditure is the dependent variable, while explanatory variables include socio-demographic characteristics, location, and interaction terms between location and income. The empirical model is showed in Equation 5:

$$\begin{aligned} Exp\_v^* &= XB_{v+}e_v \\ Exp\_f^* &= XB_{f+}e_f \qquad (5) \\ Exp\_p^* &= XB_{p+}e_p \end{aligned}$$

And Exp=0 if Exp* is negative or zero; Exp=Exp* if Exp* is positive.

where Exp*'s are the latent variables of weekly household food expenditure on fresh vegetables, fresh fruits, and peanut products, X is the explanatory variable vector, B's are

the estimated coefficients, and e's are the stochastic error terms. The error term vector is assumed to follow multivariate normal distribution in Equation 6:

$$e=(e_v, e_f, e_p)' \sim N(0, V) \qquad (6)$$

$$0 = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \quad V = \begin{bmatrix} r_v^2 & r_{vf} & r_{vp} \\ r_{vf} & r_f^2 & r_{fp} \\ r_{vp} & r_{fp} & r_p^2 \end{bmatrix}$$

where V is variance-covariance matrix of error terms, r_{ij}'s are the corresponding cross-equation correlation between equation i and j, and r_i's are the standard deviation of error terms. For example, r_{vf} is the correlation coefficients between fresh vegetables error term and fresh fruits error term. The model was estimated using maximum simulated likelihood by STATA mvtobit program (Barslund. 2009).

4 Results

4.1 ANOVA Analysis

Recalling the average weekly household expenditures on fresh vegetables, fresh fruits, and peanut products, households in Accra and Takoradi spend more on fresh vegetables and fruits but less on peanut products than Tamale households. Results of ANOVA confirmed that the location difference was statistically significant. F-statistics are 15.35 in fresh vegetable equation, 5.5 in fresh fruit equation, and 38.25 in the peanut products equation. The degree of freedoms all equal to 2, and p-values of the three separate tests are all less than 1 percent. The results indicate that the weekly household food expenditure on each of the three specific foods (i.e., fresh vegetables, fresh fruits, and peanut products) significantly varies with location.

Despite results from ANOVA supporting the regional difference exist in fresh vegetables, fruits, and peanut products expenditure, whether this disparity is from location factor itself or from the socio-demographic factors in relation to location is still not clear. Therefore, when check the location difference, controlling the socio-demographic becomes necessary. Results of further study are showed in following section.

4.2 Multivariate Tobit Model

The estimation results from Multivariate Tobit Model are stated in Table 3. According to results of Likelihood ratio test on r's, the across-equation correlations are significant in error terms, since the correlation parameters are not jointly equal to zero. In other words, the error terms in this equation system are correlated with each other. Therefore, Multivariate Tobit Model provides more efficient estimation than three separate Tobit Model. Although the three correlations are all significant positive, their magnitudes are different. The correlation of error terms is 0.60 between fresh vegetable and fruits equation, 0.29 between fresh vegetables and peanut products equation, and 0.23 between fresh fruits and peanut products equation. It indicates that fresh vegetable expenditure is more close to fresh fruits consumption than the spending on peanut products. Also, the correlation between peanut products and the other two food categories are roughly the same, but peanut products spending seems slightly close to vegetables. The finding confirms that in the traditional diet of sub-Saharan Africa, peanut products are often consumed by itself as a snack, but sometimes completing fresh vegetable and fresh fruits as well.

Fresh vegetables. Accra households have significantly higher fresh vegetable expenditure than the household in Tamale, and the gap is about 4.29 cedi weekly. However, the difference is not confirmed between Accra and Takoradi households. Because of the high economic development in relation to Southern Ghana, it does not surprise that cities in Northern Region such as Tamale have low fresh vegetable spending. Income has a significant positive effect on fresh vegetables expenditures. Well-income households tend to purse a healthier diet and consume more vegetables, which is remarkable consistent with previous studies (Hall et al. 2009; Ruel et al., 2005). Additionally, the interaction term of income and Tamale dummy is also significant, indicating that income has a larger effect in promoting fresh vegetable consumption in urban Tamale than in Accra. Furthermore, well-educated households are found to spend 1.90 cedi more on fresh vegetable every week than those households with high school or

lower education. Since the high education provides consumer more knowledge about the health benefits of fresh vegetable consumption.

Beside socioeconomic factors, the demographic characteristics such as marital status and age also have a statistic significant influence. Married households have higher food expenditures on fresh vegetables than their counterparts, because they tend to pursue more balanced diets. Moreover, due to the increasing knowledge on healthy diet, age has a positive effect. A ten-year growth in age brings about 1.3 cedi increase in weekly fresh vegetable spending.

Fresh fruits. After controlling for socio-demographic factors, the location factors don't have significant effects on the fresh fruit expenditure. It suggests that the regional difference in fresh fruits spending come from the underlying socio-demographic characteristics instead of the location itself. Similar to fresh vegetables discussed above, high fresh fruits spending are closely associated with high social status in terms of income and education. Weekly fresh fruits expenditure is found to be significantly increasing as income. Moreover, the high education leads to a 2.2 cedi premium in weekly fresh fruits expenditure. Since fresh fruits are an excellent source of various nutritions, the households with high social status are likely to consume more fresh fruits.

In terms of demographic factors, the variables such as marital status, age, and household composition are found to have significant effect in determining fresh fruits spending. High fresh fruit expenditure is closely correlated with married households. According to the results, the difference between married and other households in weekly fresh fruit expenditure is about 0.83 cedi. Moreover, as age increases, food expenditure on fresh fruits also grows substantially. A ten-year increase of age brings about 5 cedi in weekly fresh fruits spending. Furthermore, households with more adult members are found to spend more on fresh fruits, and the corresponding marginal effect is 0.39 cedi. The pattern is quite similar to that reported in developed economies.

Peanut products. Results of the study indicate that both Tamale and Takoradi households have higher peanut products expenditure than the households in Accra. The gap between Tamale and Accra households is about 1.5 cedi weekly, while between Takoradi and Accra households is 1.8 cedi. It may because the tradition diet habit such as high peanut and peanut-based product consumption still reserve in the non-capital cities. High-income households spend more on peanut products. Comparing with capital households, income has a larger effect in Tamale but a low effect in Takoradi. It suggests that the same amount income growth has different effects in the three cities. From large to small, the cities are Tamale, Accra, and Takaradi. Furthermore, well-educated households spend 0.63 cedi more on peanut products weekly. Additionally, food expenditure on peanut products are found to be positively related to the number of adult members, due to large households demand more peanut products.

5 Conclusion and discussion

In recent years, despite the significant improvement in the diet of Africa in terms of both food variety and quality, widespread micronutrient deficiency is still prevalent in many African countries. Since the health benefits of food consumption on fresh vegetables, fresh fruits, and peanut products are well established, thus integrating these high-nutrition foods in the existing diet is of crucial importance. Both health-promoting organizations and food retailers call for studies on identifying the determinants of these specific food consumption in depth. However, the location difference in food consumption has often been ignored in most of the previous research. Using a survey data of urban Ghana households in 2011, the study found out that beyond socioeconomic and demographic factors (including income, education, marital status, age, and household composition), the food expenditure on fresh vegetables, fresh fruits, and peanut products various with location, and the location factors are also found to interact with household income in determining the food expenditure.

According to the estimation results, household food expenditure on fresh vegetables, fresh fruits, and peanut products are all positively correlated with each other. Northern urban households like in Tamale had low fresh vegetable expenditure, and income was

found to have a large effect in Tamale in increasing household spending in fresh vegetables. After controlling the key socio-demographic factors, the regional difference in fresh fruits expenditure was not significant. While regarding peanut products, households in non-capital cities such as Tamale and Takoradi have high household expenditure than capital households. Also, comparing with Accra households, Tamale households are more sensitive to income change in encouraging peanut products consumption, while Takoradi households are less sensitive.

Results of the study suggest that public sectors need to take the location effect into consideration when formulate their health-promoting programs. Food aid in relation to fresh vegetables need to be focusing on the less developed area such as Northern Ghana, and moreover, increasing household income seems an efficient way in promoting fresh vegetable consumption in Ghana, especially in Tamale. However, health programs associated with promoting peanut products consumption are suggested to target Accra households. Public sectors need to concern more on noncapital households' consumption of peanut products, since they are potentially with relatively high risk of aflatoxin contamination.

Likewise, the information about the location difference in specific food expenditures can also help food retailers in making their market strategies. To be specific, vegetable promotion should target the household in more developed area such as Southern Ghana, while peanut products sales need to focus on non-capital areas.

Besides location difference, the study provides a comprehensive picture of the expenditure on health-improving foods such as fresh vegetables, fresh fruits, and peanut products in urban households of Ghana in terms of consumer profiles. The results suggest food marketers focus their promotion of fresh vegetables and fruits on the high-income and well-educated married households, while promoting peanut products to educated households with large household size. The public sector concerned about food security and nutrition needs to provide more education/training opportunity, supply specific food aid (i.e., fresh vegetables and fruits) to low-income and low-educated households, and

strive to assure that households with high peanut product expenditure face low risk of aflatoxin exposure from peanut products.

Furthermore, aflatoxin contamination is highly associated with the particular forms of peanut products. For example, peanut paste is more likely to associated with food contaminated than roasted peanuts. Therefore, not only total peanut products consumption, but also the particular consumption forms should be investigated in the further study, in order to examine the corresponding food contamination problem.

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Table 1. Descriptive statistics of variables included in the empirical model.

Variable name	Variable description / units of measurement	Mean	Std dev
Dependent variable:			
Exp_Veg	Weekly household food expenditure on fresh vegetables/in Ghanaian cedi	12.962	12.220
Exp_Fruits	Weekly household food expenditure on fresh fruits/in Ghanaian cedi	5.408	5.836
Exp_Peanuts	Weekly household food expenditure on peanut products/in Ghanaian cedi	3.293	3.383
Independent variables:			
	Demographic factors		
Married	=1 if a respondent is married	0.753	0.431
Age	Actual age in years	39.222	10.656
Age_12	Number of household members between 4-12 years old	0.945	1.067
Age_60	Number of household members between 19-60 years old	2.087	1.751
Age_61	Number of household members 61 years old or older	0.153	0.505
	Socio-economic factors		
Income	Household income in the month preceding the survey / in Ghanaian cedis	646.070	785.081
Employ_self	=1 if a respondent is self-employed	0.642	0.480
Employ_gov	=1 if a respondent is gov/civil employee	0.243	0.429
Educ	=1 if a respondent has a formal education (including Senior high/GCE O-A level, Vocational school, Technical school, Teacher training, University, or postgraduate)	0.516	0.500
	Location		
Tamale	=1 if a household is in Tamale	0.186	0.389
Takoradi	=1 if a household is in Takoradi	0.208	0.406

Table 2. Weekly household expenditure on fresh vegetables, fresh fruits, and peanut products by cities.

Weekly expenditure	Accra	Takoradi	Tamale
Fresh vegetables	14.385	11.088	9.731
Fresh fruits	5.686	5.179	4.207
Peanuts products	2.653	3.487	4.871

Table 3. Estimation results of food expenditure on fresh vegetables, fresh fruits, and peanut products in urban households of Ghana, 2011.

Variable name/Coef (std err.)	Vegetables	Fruits	Peanuts
Intercept	2.4670	-0.5218	0.7722
	(1.9754)	(0.9653)	(0.6078)
	Demographic Factors		
Married	2.2077*	0.8332*	0.2892
	(0.8459)	(0.4158)	(0.2544)
Age	0.1313***	0.0492***	0.0134
	(0.0357)	(0.0175)	(0.0107)
Age_12	0.2877	0.0539	0.1329
	(0.3536)	(0.1742)	(0.1036)
Age_60	0.2785	0.3919***	0.2022***
	(0.2108)	(0.1010)	(0.0665)
Age_61	-0.0022	-0.5183	-0.1512
	(0.7196)	(0.3471)	(0.2167)
	Socio-economic Factors		
Income	0.0040***	0.0019***	0.0004***
	(0.0005)	(0.0003)	(0.0002)
Employ_self	-0.1028	-0.0194	0.1769
	(1.1330)	(0.5556)	(0.3467)
Employ_gov	0.1759	-0.1916	-0.1977
	(1.3339)	(0.6447)	(0.4087)
Educ	1.8984**	2.2457***	0.6271***
	(0.8288)	(0.4060)	(0.2487)
	Location		

Tamale	-4.2931***	-0.3494	1.5297***
	(1.6344)	(0.8011)	(0.4775)
Takoradi	-2.2213	-0.0858	1.8178**
	(1.5139)	(0.7461)	(0.4453)
Tamale*income	0.0094***	0.0013	0.0043***
	(0.0048)	(0.0023)	(0.0014)
Takoradi*income	0.0002	0.0006	-0.0020***
	(0.0028)	(0.0014)	(0.0008)
	Parameter		
Sigma1	11.4067***		
	(0.2637)		
Sigma2	5.6309***		
	(0.1324)		
Sigma3	3.3305***		
	(0.0779)		
R12	0.6017***		
	(0.0209)		
R13	0.2864***		
	(0.0302)		
R23	0.2326***		
	(0.0313)		

Note: *, ** and *** denote significant at 10%, 5%, and 1% levels, respectively. Standard errors are in parentheses.