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DOMESTIC REMITTANCES AND HOUSEHOLD FOOD DIVERSITY IN RURAL GHANA

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ABSTRACT

This work investigates the effect of domestic remittances on households' food diversity in rural Ghana using three-stage least squares estimation technique and cross-sectional data from the Ghana Living Standards Survey, round six (GLSS 6). The study finds that Northern Ghana rural households' food diversity scores are lower than their Southern counterparts. Results show that domestic remittances positively affect rural household food diversity in Ghana, and the difference in food diversity index between Northern and Southern rural households narrows as remittances increase. The study also finds that rural households with at least primary educated householders have enhanced food consumption in variety while increasing household size tends to deteriorate food diversity. The study recommends that domestic remittances matter to food consumption diversity, especially in Northern Ghana. Therefore, policymakers should implement remittance tax credits to service providers and strengthen competition in the industry by supporting remittance technologies' interoperability to minimize costs to increase flows. Increased domestic remittance flows to Northern Ghana could narrow the rural household food diversity gap between Northern and Southern Ghana. Farm and non-farm investment and rural sector-specific education investment are also recommended.

Contribution/Originality: This study contributes to the existing literature by investigating domestic remittances' impact in narrowing food diversity gap between rural households in Northern and Southern Ghana, controlling for other household characteristics. The study's originality comes from incorporating locational differences in the remittances-food security relationship.

1. INTRODUCTION

As a lower-middle income economy, Ghana's economic growth over recent years has been, while not outstanding, steady at around or over 4% and top at 8% in 2017, which prompts its poverty reduction. Ghana is the first sub-Saharan African (SSA) country to achieve the first United Nations Millilumen Development Goal (UN-MDG) in reducing extreme poverty by half of its population between 1990 and 2015 (World Bank, 2015). The country successfully reduced its percentage of the population living on less than $1.9 a day from 41.8% in 1987 to 13% in 2016; however, considerable regional income, as well as nutrition and food security disparities remain between Northern and Southern Ghana (USAID, 2018; World Bank, 2017).

Despite Ghana's promising growth and living improvements, poverty levels are much higher in rural than in urban areas (McKay, Pirttilä, & Tarp, 2016; World Bank, 2017). In rural Ghana, poverty and food insecurity levels are much higher in Northern Ghana than in the South (GSS, 2018; USAID, 2018). Ghana's nutrition and food

security challenge remains a critical developmental issue. Food insecurity, low dietary diversity, lack of feeding practices, poor access to health services, and micronutrient intake shortage are major contributing factors to the population's poor nutritional status in northern Ghana (USAID, 2018).

Since pre-colonial times, there has been the migration of people from the North to the South of Ghana (Beals & Menezes, 1970; Cleveland, 1991; Hart, 1971). The north-south migration phenomenon is currently ongoing (Adaawen & Owusu, 2013; Darkwah, 2013; White, 2012). Historically, people have responded to the uneven spatial distribution of natural resources in Ghana, which has resulted in regional development variations with a relatively developed South and a mostly undeveloped North (Kwankye, 2012; Van der Geest, 2011). Many northern Ghana communities regard migration to the South as an investment with the migrants' remittances as returns (Kwankye, 2012).

Ghana's food-insecure households' inability to produce sufficient quantities and varieties of food to meet their needs has been linked to limited financial resources to expand production, constrained access to inputs, unfavorable weather conditions, and poor soil quality (World Food Programme, 2016). The significance of both international and domestic migrants' remittances in the socio-economic wellbeing of Ghanaian households in general (Ackah & Medvedev, 2010; Castaldo, Deshingkar, & McKay, 2012; Mazzucato, Van Den Boom, & Nsowah-Nuamah, 2008; Quartey, Ackah, & Lambon-Quayefio, 2019) and northern Ghana in particular (Abdul-Korah, 2011; Adaawen & Owusu, 2013; Kwankye, 2012; Pickbourn, 2016) has been well-documented. Despite food insecurity being a critical rural development issue for policymakers, the effect of domestic migrants' remittances on household food diversity in Ghana is unknown. Most importantly, no empirical study on the impact of domestic remittance flows on Ghana's regional gap in food diversity has been produced. Given such a scholarly shortage, this study's goal is twofold: to disclose the current condition of household food consumption diversity in rural Ghana and assess the economic impact of domestic Ghanaian migrants' remittances on the regional household food diversity gap.

This paper's structure is organized as follows: Section 2 provides a review of the existing literature. Section 3 presents the analysis method, including explaining food diversity measures, independent variables, model specification, and data sources. Empirical findings and discussion of results are in the fourth section. The last section concludes the paper and presents policy implications.

2. LITERATURE REVIEW

This study's theoretical foundation is tied to the New Economics of Labor Migration and Livelihood Approaches (NELM-LA), in which migration is modeled as the risk-sharing behavior of households. Households and individuals seem able to diversify resources such as labor in order to minimize income risks (Stark, 1991). Household members are assumed to implicitly enter into a co-insurance agreement where they invest in household members to allow them to migrate, but yet expect a return on such investment from the migrating member through repayment of the migration cost and other assistance they may require (Englama, 2009). Households perceive migration as a response to income risks, given that migrants' remittances serve as income insurance for the homes of origin. Therefore, households adopt migration and remittances as a strategy to ensure their wellbeing, including food security (Lucas & Stark, 1985).

Food security is a multidimensional concept and is measured by different indicators. It is defined as 'a situation that exists when all people, at all times, have physical, economic, and social access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for active and healthy life' (FAO, 2002). The FAO explains four interrelated dimensions of food security – availability, accessibility, utilization, and stability (FAO, 2008, 2009). This study focuses on the category of indicators that measure household food access. These indicators measure households' ability to acquire adequate quantity and quality food to meet the nutritional needs of all members for productive lives (Maxwell, Coates, & Vaitla, 2013; Swindale & Bilinsky, 2006a; Swindale & Bilinsky, 2006b).

A useful approach for measuring household food access, validated by several studies (Carletto, Zezza, & Banerjee, 2013; Leroy, Ruel, Frongillo, Harris, & Ballard, 2015; Maxwell et al., 2013; Wiesmann, Bassett, Benson, & Hoddinott, 2015) is household food diversity, measured as the number of unique foods consumed by household members over a given period (FAO, 2010, 2018; Maxwell et al., 2013; Peng & Berry, 2019; Swindale & Bilinsky, 2006b). The importance of dietary variety is based on several studies (Fernandez, D'Avanzo, Negri, Franceschi, & La Vecchia, 1996; Jansen et al., 2004; Kant, Schatzkin, Harris, Ziegler, & Block, 1993; Michels & Wolk, 2002) showing that positive health outcomes accompany diverse diets. A household food diversity index considers the households' food expenses as a share of the household income; hence high correlation between income and food diversity has been found. Increased food expenditure resulting from additional income is associated with increased quantity and quality of the diet, even in impoverished households (Swindale & Bilinsky, 2006a). Since remittances are a vital part of receiving household income(Masron & Subramaniam, 2018), several studies have investigated the economic impact of remittances on households' food security.

While poverty reduction impacts of remittances have been investigated in developing countries (Masron & Subramaniam, 2018) some studies have also analyzed the food security impacts of remittances. UN-INSTRAW (2008) reported that remittances directly contribute to improved food security of receiving households in the Philippines, while it fosters increased consumption of quality foods, including imported items, due to a significant change in food consumption patterns. Some studies have confirmed that remittances sent by migrants in Turkey improve the receiving households' welfare in staple consumption and housing as opposed to households with no remittance receipts. Likewise, Gustafsson and Makonnen (1993) concluded that in Lesotho, a country encircled by South Africa, remittances typically increased food consumption per capita by 35 percent on average among recipient families, whereas it was also noted that Lesotho's poverty rate would unexpectedly ascend by nearly 15 percent when Lesotho migrant workers in South African mines were not remitting their earnings.

Several other studies have affirmed its indirect effect on welfare in non-receiving households. For example, Durand, Kandel, Parrado, and Massey (1996) disclosed an increased consumption and income improvement of non-receiving households in rural Mexico thanks to the productive investment made by their neighboring remittance-receiving families. Conversely, Jimenez (2009) asserted that the consumption patterns might not differ significantly between the remittance-receiving and non-receiving households, but food expenditures of remittance-receiving households were observed to be higher in the Mexican town of Tlapanalá.

Concerning research on food security in Ghana, Darfour and Rosentrater (2016) disclosed that 34 percent, 15 percent, and 10 percent of the populations in the Upper West, Upper East, and the Northern regions of Ghana are vulnerable in terms of food supply, in aggregate, representing 1.5 million dwellers of both rural and urban areas. The study considered the food security dimensions of availability, accessibility, utilization, and stability. Studies that have primarily focused on the determinants of food security in Northern Ghana assert that consumption of less preferred food and reduced food intake, household asset sales, migration to Southern Ghana for wage labor, monetary and food remittances are some of the food security coping mechanisms in Northern Ghana (Chagomoka et al., 2016; Kuuire, Mkandawire, Arku, & Luginaah, 2013; Nimoh, Samuel, & Yeboah, 2012).

However, household strategies of migration and remittances have been found to be not sufficient to alleviate the food insecurity situation in some parts of Northern Ghana (Atuoye, Kuuire, Kangmennaang, Antabe, & Luginaah, 2017). Nonetheless, non-farm work income positively affects household food security in Northern Ghana (Owusu, Abdulai, & Abdul-Rahman, 2011) and rural Ghana remittance-recipient households use their remittance income for consumption (Dary & Ustarz, 2020). In terms of the determinants of domestic migration, Anarfi, Kwankye, Ababio, and Tiemoko (2003) suggested that urban-rural income differentials and the results of imbalanced socio-economic development and lopsided resource allocation between Northern and Southern Ghana affect internal migration.

Agyei (2016) uncovered that migrants' remittances are crucial to Ghanaian rural households as remittances tend to improve food security and other life aspects, including access to farmland and self-supply farm output. Adaawen and Owusu (2013) concluded that Ghanaian youth (15-24 years old) typically migrate from Northern to Southern Ghana for higher-paying jobs, who often send financial supports to their Northern families for food consumption and other household maintenance and improvement. Smith and Floro (2020) argue that both international and domestic migrants' remittances serve as a mechanism for reducing food insecurity and poverty in developing countries, with international remittances having a greater impact than local remittances. However, Aguayo-Téllez, García-Andrés, and Martinez (2020) argue that while foreign remittances have a larger impact on expenditure shares of durable goods, domestic remittances have a larger impact on food, education, and health shares of income. Domestic remittance flows positively impact Ghana's poorest areas (Castaldo et al., 2012; Mazzucato et al., 2008).

3. METHOD OF ANALYSIS

3.1. Food Diversity Measures

This study used the Berry Index and the USAID's Food and Nutrition Technical Assistance (FANTA) 's Household Dietary Diversity Score (HDDS) to evaluate domestic remittances' impact on household food diversity (Swindale & Bilinsky, 2006b). The Berry Index values range between zero and one; the higher the index value, the greater the degree of diversity in food consumption. Suppose a household's total food spending is on a single classified food-group. In that case, the Berry index is zero (implying no food diversity) while coming close to unity if it spreads among a number of food groups (Berry, 1971). The Berry Index as a measure for each household food diversity is given in Equation 1 as:

$$BFDI_i = 1 - \sum_{j=1}^{10} s_{ij}^2 \quad \text{where} \quad s_{ij} = \frac{T_{ij}}{\sum_{j=1}^{10} T_{ij}} \tag{1}$$

where $BFDI_i$ is Berry food diversity index for the *ith* household and s_{ij} is the expenditure share of the *jth* food group in the consumption basket of the ith household. T_{ij} is the amount of money (in Ghana cedis; GH₵) spent on food group *j* by household *i* over the reference period. This measure's advantage is that its dietary diversity quality can be assessed based on the food expenditure and allows mapping of determinants of food security dimensions at the local and national levels. The disadvantage is that it does not account for food wasted as well as ignore the time aspect within which the food is consumed. It does not distinguish whether the observed food variety results from different healthy or unhealthy products (Drescher, Thiele, & Mensink, 2007).

FANTA's HDDS measures the number of different food groups categorized into 12 subgroups, consumed by a household over a given reference period on the 24-hour recall time. HDDS is an appealing proxy because a more diversified diet is an important outcome in and of itself. It is associated with a number of improved outcomes in areas such as birth weight, child anthropometric status, and improved hemoglobin concentrations (Swindale & Bilinsky, 2006a; Swindale & Bilinsky, 2006b). Typically, HDDS is used in the socio-economic analysis of an entire household. This study adopts a revised version of HDDS based on ten food groups (as shown in Table 1) while using the GLSS criteria allowing the 7-day recall period due to data unavailability (i.e., 24-hour window of the HDDS procedure). The study made the household food consumption assessment based on the ten food groups. When a household consumes one food group, it is scored 1; 2 for two food groups; 3 for three food groups; up to 10 for ten food groups. The HDDS variable is calculated for each household in Equation 2 as:

$$HDDS_i = \sum_{j=1}^{10} FG_{ij} \quad (2)$$

Where $HDDS_i$ is the food diversity score for the *ith* household and FG_{ij} is the number of the *jth* food group in the consumption basket of the ith household. The HDDS value ranges from 1 to 10 and is normalized from 0.1 to 1.0. In general, this measure's advantage is that it measures food diversity directly across a household to offer an understanding of intra-household food consumption. However, this measure relies heavily on respondents' memory, which may lead to measurement errors. Meanwhile, the adjustment of recall estimates can be potentially a challenge to the survey-taker leading to measurement discrepancies. As opposed to the HDDS 24-hour recorded frequency, the recall period of GLSS data was at least one week, which hypothetically may weaken the accuracy of the assessment due to imperfect recall (Swindale & Bilinsky, 2006b). Both the Berry Index and HDDS were constructed based on all foods at the subsistence level consumed by households, categorized into ten subgroups from the GLSS data shown in Table 1.

Table-1. Food items used in measuring Berry index and HDDS, based on the GLSS 6 data.

Food group	Example of the food item
Cereals	guinea corn/sorghum, maize, millet, rice-local rice imported, other cereals, bread (sugar), other bread, biscuits, flour (wheat), maize ground/corn dough, kenkey/banku without sauce baby food, cereals, etc. other cereal products.
Meat and poultry	Corned beef, pork, beef, goat meat, mutton, bushmeat/wild game, other meat (dog, cat, etc.), chicken, other domestic, poultry game birds.
Fats and oils	coconut oil groundnut oil palm oil palm oil shea butter margarine/butter other vegetable oil
Fruits	Coconut, banana, orange/tangerine, pineapple mango, avocado pear, watermelon, canned or processed fruits, other fruits (not canned), fruits juices
Vegetables	cocoyam leaves (kontomire), garden eggs, okro, Carrots, pepper (fresh or dried), onions (large), tomatoes (fresh), tomato puree, other vegetables.
Confectionaries	sugar (cube, granulated), honey, ice cream, ice lollies, etc. other confectionaries
Condiments	black, pepper, salt, ginger, other spices.
Starchy staples	cassava, cocoyam, plantain, yam, other starchy staples, cassava-dough, gari, fufu/tuo with soup.
Pulses	Beans, groundnuts nuts, palm nuts, other pulses
Coffee, tea, etc.	Coffee, chocolate (including milo bournvita) tea or other drinks

Source: GSS (2014).

Table-2. Variable description.

Variable	Measurement
Household Food Diversity (HFD) Measures: *(1) Berry Food Diversity Index (BFDI), also known as Berry Index* *(2) Household Dietary Diversity Score (HDDS)*	BFDI: One minus the summation of expenditure share of *j*th food group in the consumption basket of the ith household (i.e., BFDI lies between 0 and 1). HDDS: Summation of the total number of food groups (1-10) consumed by households. (i.e., normalized HDDS lies between 0.1 and 1.0).
Amount of domestic remittances	Amount of domestic remittance from domestic migrants received per household (in GH₵)
Number of domestic migrants	Number of domestic migrants per household
Householder level of education	Householder level of education (1: No school; 2: Basic Education; 3: Middle School;4: High School; 5: Vocational/Technical School; 6: Tertiary)
Number of household members	Number of household members per household
Value of household assets	Value of household assets (in logs; in GH₵)
Gender of household head	0=female;1=male
Region of household Location	1=if household is in Northern Ghana

	(Northern; Upper East; Upper West), 0=otherwise
Gender of the migrant	1=male; 0=female (in household unit)
Household relationship to remitting migrant	1=immediate family; 0=otherwise

Source: FAO (2010); GSS (2014).

3.2. Model Specification

The primary econometric model is to test the hypothesis that remittances affect household food diversity as they critically are funds to income-constraint households for food consumption.

$$HFD_i = \alpha_0 + \alpha_1 M_i + \alpha_2 R_i + \beta X_i + \mu \quad (3)$$

where HFD_i is household food diversity measure by Berry Index and FANTA's HDDS. M_i and R_i are respectively the total number of migrants and the amount of domestic remittances received by each *ith* household. X_i is a vector of other variables shown in Table 2 that may influence household food diversity by various household characteristics. A note regarding the domestic migration pattern is that the migratory flow is typically from the north to south of Ghana due to the relative and stronger economic development in the south region.

Since M_i and R_i are endogenous, a three-stage least squares model (3SLS) was estimated by identifying instrumental variables (IV) for M_i and Ri (Kaninda & Fonsah, 2014; Quinn, 2009). In the first and second stages, OLS equations were estimated. Since the remittances and migration variables were continuous, the OLS was implemented for both R_i and M_i, of which the two equations can be expressed as:

$$M_i = \gamma_0 + \gamma_1 Z_i + \gamma_2 X_i + \varepsilon \quad (4)$$

$$R_i = \phi_0 + \phi_1 W_i + \phi_2 X_i + \nu \quad (5)$$

Where Z_i and W_i are the vectors of instruments for M_i and R_i respectively. Here, the gender of the migrant and the household relationship to the migrant are two IV, represented by Z_i, given the fact that the migrant gender and his/her relationship to the household affect the migration outcome but not directly affecting the food diversity. The migrant's remittance (R_i) is also instrumented with the migration variable (M_i) and the migrant's household relation, represented by W_i, equally not affecting any food diversity. In the third stage, the predicted values of M_i ($\hat{M}_i$) and R_i ($\hat{R}_i$) from Equations 4 and 5 are included as explanatory variables in the HFD_i function (see Equation 3), as formulated in Equation 6 instead of M_i and R_i. Therefore, Equation 3 can be rewritten as:

$$HFD_i = \alpha_0 + \alpha_1 \hat{M}_i + \alpha_2 \hat{R}_i + \beta X_i + \mu \quad (6)$$

Here, the gain from using the 3SLS model in Equation 6 is that endogeneity of the migration, and the remittances variables are accounted for, allowing a more accurate relationship between the household food diversity and domestic migrant remittances to be drawn. The study further hypothesizes that household food diversity's responsiveness to domestic migrant remittances depends on the region of household location. It helps to examine the effect of the complementarity of remittances over the household location, which influences household food diversity. Consequently, a specification for regional interactive effects is given in Equation 7 as:

$$HFD_i = \alpha_0 + \alpha_1 \hat{M}_i + \alpha_2 \hat{R}_i + \alpha_3 (\hat{R}_i * H_i) + \beta X_i + \mu \quad (7)$$

where H_i is the region of Ghanaian household location, while other variables are explained throughout the above equations.

3.3. Source of Data

The data for this study was obtained from the Ghana Living Standard Survey, round six (GLSS 6) conducted by the Ghana Statistical Service (GSS), covering the time period from October 18, 2012, to October 17, 2013 (GSS,

2014). The survey adopted a two-stage stratified sampling design. One thousand two hundred enumeration areas (EAs) were selected to form the primary sampling units (PSUs) at the first stage. A nationally representative sample of 18,000 households in the 1,200 enumeration areas was surveyed. Using probability proportional to population size (PPS), the PSUs were allocated among the ten regions. At the second stage, 15 households from each PSU were selected systematically, summing to 18,000 households nationwide. Sixteen thousand seven hundred seventy-two of all sample households were enumerated, leading to a response rate of 93.2 percent, of which 7,445 urban households and 9,327 rural households were sampled. The GLSS data has detailed information on food consumption diversity variables and other household and community characteristics.

4. EMPIRICAL FINDINGS AND DISCUSSIONS

4.1. Preliminary Statistics on Household Poverty and Migration Outlook

Figure 1 shows the incidence of poverty by region for the three rounds (2005/06; 2012/12; 2016/2017) of GLSS data. Northern Ghana comprising the Upper West, Upper East, and Northern regions, has high incidences of poverty than Southern Ghana, which is made up of the other seven South regions. There has been a reduction in the percentage of people living below the poverty line except for the Northern region, which faced high poverty in 2016/17. As most households still live on less than $1.9 a day, this poverty outcome is suggested to be correlated with households' economic inability to access a variety of foods (USAID, 2018).

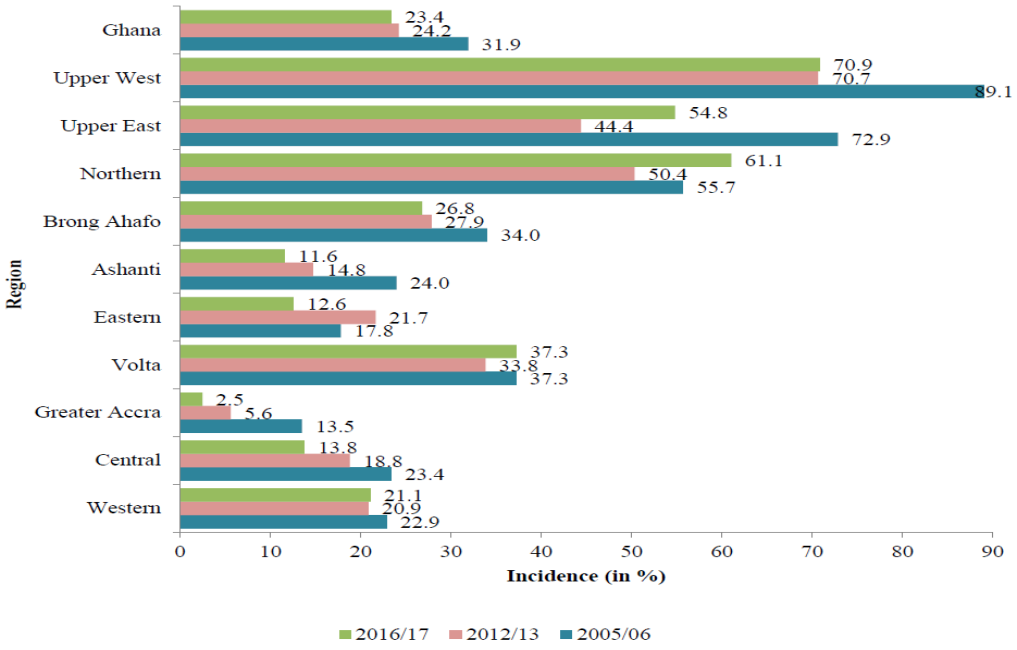

Figure-1. Poverty incidence in Ghana by region (Poverty Line (annual household income) = GH₵1,314 or US$292; US$1= GH₵4.50; exchange rate of 2017 (annual average))
Source: GSS (2018).

Domestic migration in Ghana is mostly from the less developed rural areas in Northern Ghana to the developed urban cities in Southern Ghana (Adaawen & Owusu, 2013; Kwankye, 2012). According to GSS (2014) 61.7 percent of domestic migrants migrate because of family or monetary reasons, while 38.3 percent of migrants move due to other factors. From the 2012/2013 GLSS Survey, 51.7 percent of migrants mostly from Northern Ghana moved to the Greater Accra Region of the South due to the needs of accompanying their parents, marriage, spouse's employment, and other family factors, while 26.2 percent of migrants moved to seek for formal employment in Greater Accra. Likewise, 62.3 percent of Ghanaians migrated to other urban areas aside from Greater Accra due to various family needs.

Across rural lands, the proportions that migrated due to family considerations were higher as opposed to the job transfers (e.g., 64.6% disclosed in the rural forest of the Brong Ahafo, Ashanti, and Eastern regions; 65.9% in rural coastal of the Volta, Western, Central, and Greater Accra areas, and 76.6% in rural savannah of the Upper West, Upper East, and Northern regions). The rural-to-urban migrants normally send remittances back to their households of origin, commonly in the forms of cash, gifts, and food. The GLSS data's remittances are defined based on the monetary value of all gifts, food, and cash sent by migrants. The GLSS survey period follows the monthly frequency between October 2012 and October 2013.

Table 3(a) and 3(b) summarize the composition of all 9,327 rural households in Ghana regarding their migration status, the overall household outlook in targeted Northern Ghana versus the South, and their corresponding family condition in food security. Among them, around one in every three households has its family member(s) migrate(s) domestically or internationally, while the rest majority (65.28%) has no leaving household member afar for work. In sum, domestic urban-rural migration occupied 32.44% (3,026 rural households), and the migrant workers reported that different portions of their earnings were remitted to their homes of origin. A point worth noting is that, according to the GLSS statistics, remittance per Ghanaian worker moderately contributes to the annual household expenses. Among the 3,026 rural households, the yearly household expenses per household were averaged GH₵ 1,009 (US$224.22), supported by the annual domestic remitted income of around GH₵ 403.7 (US$89.71), which covers approximately 40% of the household spending.

From the GLSS data, of the 9,327 rural households, 3,512 were in Northern Ghana, and 5,815 were in the South. 32.44% (or 3,026 out of 9,327) of these rural households have domestic migrants and received remittances; of the rural households with domestic migrants and receiving remittances, 35.39% (1,071 out of 3,026) were in Northern Ghana. Northern Ghana (with only three regions) had 30.5% (1,071 of 3,512) of its rural households with migrants' remittances. In comparison, Southern Ghana (with seven regions) had 33.6% (1,955 out of 5,815) of its rural household migrants' remittances. With a 3.1% difference (33.6% minus 30.5%) between Northern Ghana and the South and fewer total households in Northern Ghana (3,512 compared with 5,815 of South), it is evident that Northern Ghana contained higher relative migratory intensity.

Table-3(a). Number of rural households with or without migrants and remittances.

Rural households	No. of households	Percent (%)
With no migrants and remittances	6,089	65.28
With domestic migrants and remittances	3,026	32.44
With international migrants and remittances	212	2.27
Total (all rural households across Ghana)	9,327	100

Note: Based on GSS data description, all households with migrants receive remittances.

Table-3(b). Number of rural households with domestic migrants and remittances.

Intra-regional migration and remittances of rural households	No. of households with migrants and remittances; Total = 3,026	Percentage (%)
Northern Ghana	*Sum: 1,071*	*Sum: 35.39*
Upper West Region	353	11.67
Upper East Region	392	12.95
Northern Region	326	10.77
Southern Ghana	*Sum: 1,955*	*Sum: 64.61*
Brong Ahafo Region	243	8.03
Ashanti Region	346	11.43
Eastern Region	356	11.76
Volta Region	467	15.43
Greater Accra Region	43	1.42
Central Region	229	7.57
Western Region	271	8.96

Sources: GSS (2014).

Table 4(a) summarizes the descriptive statistics of key continuous variables. In general, the average BFDI for all the 3,026 rural households is about 0.601, and a lower standard deviation indicating that the BFDI data point tends to be close to the mean. However, the average HDDS for all households is about 0.504, with a relatively high standard deviation. The average household size across all 3,026 rural households is 4.413, and the average domestic migrant per household is about 1.515, or approximately 2. Per annum, a household received an average of GH₵403.76 (or around US$90) in remittances, while each family maintained a mean value of household assets at GH₵804.32 (about US$180).

Table 4(b) presents other relevant categorical variables. Of the education of rural household heads, most (65.70%) retained no formal schooling years. Around 25% of householders completed the primary- or middle-school education. High-school or the equivalent vocational/technical diploma earners occupied only about 7%, while the tertiary- or college-level completion just meagerly reached less than 2%. It is assumed that the higher education a rural householder obtains, the higher likelihood of the economic ability to access a variety of foods. For all other dummy variables, the statistical descriptions are summarized and aligned as stated in Table 2, with highlights of (1) rural Ghanaian households are male-dominated, resulting in primary male-household leadership; (2) twice as much of rural households spread across Southern regions than the northern dispersed counterparts, and (3) more females than males are sent remotely as domestic migrants, who are the immediate family members to the households.

Table-4(a). Summary statistics of key continuous variables.

Variable	Mean	SD	Min	Max
Household Food Diversity (HFD) Measures:				
(1) Berry Food Diversity Index (BFDI), also known as Berry Index	0.601	0.103	0.000	0.953
(2) *Household Dietary Diversity Score (HDDS)*	0.504	0.288	0.100	1.000
Domestic remittance received (in GH₵)	403.76	620.17	2.00	7,350.00
Number of domestic migrants	1.515	0.774	0.000	3.000
Number of household members	4.413	2.871	1.000	25.00
Value of household assets (in GH₵)	804.32	2.641	31.658	17,623.70

Table-4(b). Summary statistics of other categorical variables.

Variable	Category	Frequency	Percent (%)
Householder level of education	1: No education	1,988	65.70
	2: Basic Education	329	10.97
	3: Middle School	443	14.64
	4: High School	127	4.20
	5: Vocational/Technical School	87	2.88
	6: Tertiary	52	1.72
	Sum	*3,026*	*100*
Gender of householder	0: Female	1,052	34.77
	1: Male	1,974	65.23
	Sum	*3,026*	*100*
Region of household location	0: Southern Ghana	1,955	64.61
	1: Northern Ghana	1,071	35.39
	Sum	*3,026*	*100*
Gender of migrant	0: Female	1,549	51.19
	1: Male	1,477	48.81
	Sum	*3,026*	*100*
Household relationship to remitting migrant	0: Non-Immediate family	1,037	34.27
	1: Immediate family	1,989	65.73
	Sum	*3,026*	*100*

4.2. Empirical Results

The 3SLS estimation results are summarized in Table 5. The 3SLS model is used with real benefits, which generates a preferably accurate relationship between household food diversity and domestic migrants' remittances

addressing endogeneity. Prior to employing 3SLS, the 2SLS experiment was conducted (see Appendix A), with its empirical results aligned with those from 3SLS. Fundamentally, the 2SLS technique allows the detection of endogeneity of the variable of interest (i.e., domestic remittances) and the validity of instrumental variables (IV) used in the analysis (see Appendix B for correlation analysis). The 3SLS technique increases the analytical efficiency of the estimates.

The analytical proposition asserts that, on average, rural households in Northern Ghana have lower food diversity than rural households in the South. Using the BFDI as the food diversity measure, the *constant* term (0.554), statistically significant at α=1% level, is the estimated mean food diversity index for Southern Ghana households with an average remittance inflow. The estimated mean food diversity index for Northern Ghana rural households with an average remittance inflow equals 0.524 (i.e., 0.554 - 0.030). However, the regional food diversity gap of 0.030 is not the same for every remittance inflow, the interaction term (remittances×region of household location) is statistically significant at α=1% level. It implies that a 1 cedi increase in remittances increases the BFDI of Southern rural households by 0.006 and Northern rural households by 0.014 (i.e., 0.006 + 0.008), *ceteris paribus*.

Using the HDDS as the measure of food diversity, alternatively, shows a similar outcome as the BFDI in terms of the coefficients' signs, size of the effects, and statistical significance levels. The positive *constant* term suggests that rural households in Southern Ghana with average remittance inflows will have an HDDS of 0.223. In contrast, Northern Ghana rural households will have an HDDS of 0.179 (i.e., 0.223-0.044) with average remittance inflows. Since the interaction term (remittances and regional household location) is statistically significant at α=1%, a 1 cedi increase in remittances will, *ceteris paribus*, increase the HDDS of Southern rural households by 0.051 and Northern rural households by 0.056 (i.e., 0.051 + 0.005).

This study's findings support the results of previous studies that domestic remittances positively impact the poorest segments of society than international remittances (Aguayo-Téllez et al., 2020; Castaldo et al., 2012; Masron & Subramaniam, 2018; Mazzucato et al., 2008). However, this study's uniqueness comes from its analysis of how domestic remittances affect rural households' economic ability to access a variety of foods in Ghana, incorporating regional differences in the remittances-food security relationship. The study's results show that domestic remittances affect rural households' economic ability to access a variety of foods in Ghana, yet, domestic remittances have a more considerable impact on Northern Ghana rural households than their southern counterparts. These results have policy implications for establishing remittance credits and strengthening competition by supporting remittance technologies' interoperability to minimize costs and expand the scale.

Other explanatory variables (householder level of education and household size) included in the analysis with statistically robust results (α=1% or α=5%) are also discussed. Regarding householder's education, results show that the economic ability to access a variety of foods increases for families with a householder with at least primary education compared to families with a householder with no education. Education of a householder increases the household's economic ability to access a variety of foods since it increases the member's employability and income. This finding corroborates other studies' results (Aidoo, Mensah, & Tuffour, 2013; Tuholske, Andam, Blekking, Evans, & Caylor, 2020). Different higher education levels held by household heads reveal similarly positive impacts on food diversity, although neither of them is statistically significant. The statistical insignificance could be owing to the negligible number of advanced-degree earners in these rural households.

On the contrary, rural household food diversity can significantly (α=1%) be impaired by the *number of household members*. A household with more residents tends to reduce its food diversity more than those with fewer members. Typically, it suggests that large-size homes would possibly have fewer resources to focus on food quality and delicacy. In particular, a household with more members may have a limited meal budget, and each member could have less access to a variety of foods. This result confirms other studies' results (Farzana et al., 2017; Owoo, 2020).

Table-5. Effect of domestic remittances on food diversity in the household of origin, 3SLS.

Variable	BFDI		HDDS	
	Without regional interaction	With regional interaction	Without regional interaction	With regional interaction
Constant	0.662*** (48.77)	0.554*** (62.31)	0.348*** (6.61)	0.223*** (5.03)
Amount of domestic remittances	0.005** (2.33)	0.006*** (10.33)	0.015* (1.82)	0.051*** (5.35)
Number of domestic migrants	0.013 (0.59)	0.028 (1.60)	0.019 (0.13)	0.035 (1.55)
Householder education level (Reference: No school)				
Basic school	0.012*** (7.74)	0.032** (2.40)	0.027 (0.43)	0.198* (1.81)
Middle school	0.010*** (7.05)	0.007 (.67)	0.018 (.32)	0.048 (0.46)
High School	0.038 (1.55)	0.088 (0.45)	0.043 (0.44)	0.232 (1.42)
Vocational/Technical School	0.093** (3.17)	0.031 (1.31)	0.058 (0.51)	0.204 (1.56)
Tertiary	0.027 (0.73)	0.002 (0.91)	0.034 (0.23)	0.023 (0.10)
Number of household members	-0.016*** (-8.37)	-0.020*** (-8.12)	-0.005** (-2.10)	-0.018* (-1.78)
Value of household assets (in log)	-0.006 (-0.37)	-0.002* (-1.75)	-0.087 (-1.53)	-0.003 (-0.06)
Gender of household head	.0061*** (4.38)	0.001 (0.82)	.031 (0.55)	0.069 (0.73)
Region of household location	-0.019 (-0.91)	-0.030** (-2.03)	-0.013 (-1.64)	-0.044** (-2.29)
Amount of domestic remittances *Region of household location (1= Northern Ghana; 0=South)		0.008*** (32.69)		0.005*** (4.89)
Number of Observations	3026		3026	

Note: *: significant in α=10%; **: significance in α=5%; ***: significance in α=1%; ()= t-statistics.

5. CONCLUSIONS AND POLICY IMPLICATIONS

This study examined the effect of domestic remittances on the regional household food diversity gap in rural Ghana. The study employed the three-stage least squares (3SLS) estimation technique to investigate the food diversity effects of remittances using the GLSS 6 data. The empirical findings suggest that rural household food diversity in Northern Ghana is lower than in Southern Ghana. Using the food diversity measures of BFDI and HDDS, this study tested the hypothesis that the relationship between the inflows of remittances on the recipient rural households' economic ability to access food in variety was different in Northern Ghana than in the South. Results show that an increase in domestic remittances leads to a rise in rural households' economic ability to access a variety of foods in both Northern and Southern Ghana, but the food diversity effect of remittance inflows is more considerable in Northern Ghana than in the South. Thus, domestic remittance flows to Northern Ghana could narrow the food diversity gap between rural households in Northern and Southern Ghana. Household food diversity tends to increase for homes where householders have primary school attainment; food diversity tends to be deteriorated by large household size. As noted in section 3.1, this study is limited in scope due to the drawbacks of measuring food diversity indicators. Future studies can expand food diversity measures and compare the food diversity effect of remittances on both receiving and non-receiving rural households. Nonetheless, some policy implications can be drawn based on the empirical results:

5.1. Introducing Remittance Tax Credit Program and Encouraging Interoperability of Remittance Technologies

First, rural food insecurity engenders developmental concern to every government, especially as rural-disfavored emigration may send resources away and deteriorate existing food conditions. In designing rural food security policies, the Ghanaian government should attend to the migration pattern and migrants' remittances by incentivizing migrants to send remittances home. A program such as 'remittance tax credits' can be offered to remittance service providers sector tantamount to senders' and recipients' fee reduction to potentially increase remittances to support the home-based community development through migrant's home of origin consumption and investment. From a micro standpoint, household access to a variety of foods may be enhanced through such a system. Simultaneously, the local community's well-being at the macro level may also be improved (i.e., community benefits from the multiplier effect of increased household spending in migrant's home of origin). The government should also strengthen competition in the sector by supporting remittance technologies' interoperability to minimize costs and expand the scale.

5.2. Improving Rural (Sector-Specific) Education and Human Capital Investment

Second, welfare assurance in rural education should also be accentuated. Intuitively, urban-rural economic differentials drive an urban influx of migration while causing negative rural brain-drain and presumably increasing the number of 'educated unemployed' due to expanded and competitive labor force in cities. To alleviate such a flaw in human capital transfer, sector-specific and vocational-based education to rural population become essential. As opposed to implementing public and general education, the government's rural spending can be allotted to educate rural citizens on agrarian production and specialization, use of agricultural technology, and creation of agri-business environment (e.g., farming and leisure resort). Consequently, as rural households are endowed with farming expertise and productivity, higher rural food security and welfare can be achieved, and hence less imbalanced rural-urban migration would occur.

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Appendix-A. Effect of domestic remittances inflows on food diversity in the household of origin, 2SLS.

Variable	BFDI		HDDS	
	Without regional interaction	With regional interaction	Without regional interaction	With regional interaction
Constant	0.628*** (67.28)	0.403 *** (9.98)	0.310*** (8.61)	0.212*** (8.85)
Amount of domestic remittances	0.002** (9.32)	0.004*** (3.57)	0.012* (1.92)	0.041*** (6.51)
Householder education level (Reference: No school)				
Basic school	0.001** (7.27)	0.004** (3.16)	0.018 (0.03)	0. 086*** (7.80)
Middle school	0.010*** (7.49)	0.009 (0.57)	0.018 (0.42)	0.026 (1.41)
High school	0.003 (1.35)	0.001 (0.52)	0.013 (0.04)	0.056 (1.35)
Vocational/Technical school	0.009** (3.29)	0.005 (1.13)	0.027 (0.77)	0.055 (1.12)
Tertiary	0.003 (0.84)	0.001 (0.43)	0.012 (0.38)	0.024 (1.04)
Number of household members	-0.006*** (-10.29)	-0.015*** (-6.40)	-0.003* (-1.83)	-0.008* (-1.92)
Value of household assets (in log)	-0.006 (-0.46)	-0.067 (-0.17)	-0.012 (-1.49)	-0.020 (-1.65)
Gender of household head	0.007*** (6.18)	0.001 (1.39)	0.019 (0.90)	0.124* (1.64)
Region of household location	-0.004* (-2.36)	-0.028* (-4.03)	-0.011* (-1.90)	-0.018** (-2.52)
Amount of domestic remittances *Region of household location (1= Northern Ghana; 0=Southern)		0.007*** (4.98)		0.003*** (3.82)
Number of Observations	3026	3026	3026	3026
Weak IV tests	F(3015) = 232.05 Prob > F = 0.0000	F(3013) = 60.82 Prob > F = 0.0000	F(3000) = 237.66 Prob > F = 0.0000	F(3013) = 61.08 Prob > F = 0.0000
Hasen J Chi-square (2)	2.645 (P-value = 0.1039)	1.897 (P-value = 0.1130)	2.056 (P-value = 0.1516)	1.515 (P-value = 0.2184)

Note: *: significant in α=10%; **: significance in α=5%; ***: significance in α=1%; () indicates t-statistics.

Appendix-B. Correlation Analysis.

(Food Diversity Measures: BFDI; HDDS; Domestic Remittances; Instrumental Variables (IV): Migrants; Gender of Migrant; Household Relationship).

	BFDI	HDDS	Domestic Remittances	Migrants	Gender of Migrant	Household Relationship to Remitting Migrant
BFDI	1.0000					
HDDS	0.3641 (0.045)**	1.0000				
Domestic Remittances	0.1068 (0.000)***	0.0935 (0.029)**	1.0000			
Migrants	0.0239 (0.189)	0.0215 (0.236)	0.2828 (0.000)***	1.0000		
Gender of Migrant	-0.0091 (0.621)	-0.0024 (0.894)	-0.013 (0.484)	-0.2913 (0.000)***	1.0000	
Household Relationship to Remitting Migrant	0.0104 (0.568)	0.0024 (0.894)	0.2320 (0.000)***	0.0978 (0.000)***	-0183 (0.313)	1.0000

Note: *: significant in α=10%; **: significance in α=5%; ***: significance in α=1%; () indicates p-values.