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**Moving Towards the USDA Food Guide Pyramid Food: Evidence from
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Moving Towards the USDA Food Guide Pyramid Food: Evidence from Household Food Group Choice in Vietnam*

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ABSTRACT

Consumption choices and behaviour of households influence well-being and demand for food products. For healthy eating and well-being households make choices such that the recommended daily calories are met. Such household choices are generally informed by a Food Guide (FG). Evidence suggests that households' daily calorie intake may differ significantly from that suggested by their FG. In this paper, the extent to which Vietnamese households' consumption choices follow the US FGP guidelines is examined. Factors that determine the number of FGP food items and food groups, chosen by households in Vietnam, are identified. Data from the Vietnamese Living Standards Survey (VLSS), for the periods 1992/93, 1997/98, 2002 and 2004 are used. In addition, household consumption choices are analysed using a binary logit frameworks. Six food groups, namely: breads, cereals, rice and pasta (F1), fruits (F2), vegetables (F3), meats, poultry, dry beans, eggs and nuts (F4); milk and milk products (F5); and, fats, oils, drinks, sweets and cakes (F6), are considered. Preliminary results suggest that the demographic and regional characteristics determine the number of FGP food groups chosen, and the number of food items consumed by Vietnamese households over the period 1992-2004. The observed changes in food group choices over the four survey periods have implications for calorie intake and expenditure poverty, malnourishment, income and wealth generation in Vietnam.

Keywords: Food Guide Pyramid, Consumption Choice, Food Group Choice, Binary Logit Analysis

JEL Classification: C35; D12; I12; O18; O53.

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1. INTRODUCTION AND MOTIVATION

Food choices made by households and individuals affect health and well-being as well as the demand for food products. Healthy diets have become a major concern for consumers, researchers and policy makers. In addition, food insecurity (interpreted as calorie deficiency or access to a minimum number of calories) has dominated research. Policy makers are proposing that adherence to a suitable food guide, coupled with increased incomes and food availability, should assist households achieve their required calorie intake from their diets. The most influential document that is provided as a guide to good nutrition is the Food Guide Pyramid (FGP) proposed in 1992 by the United States Department of Agriculture (USDA). The FGP is aimed at informing households about nutrition that promotes well-being. The FGP communicates three key concepts that are the cornerstone of dietary guidelines: namely, dietary variety, proportionality and moderation (Basiotis et al. 2002; Goldberg et al, 2004). The FGP is a guide on the proportions of food items to be consumed by households. The FGP, therefore, helps consumers make informed consumption choices food pyramid groups.

The Food Guide Pyramid (FGP) classifies food items into distinct food groups and provides information on the quantity and calorific value of food to be consumed from each of the pyramid food groups. The pyramid presents, therefore, information about consumption of food from each of the pyramid food groups. This information includes suggestions on (i) how much of each food category must be consumed each day; (ii) the range of servings of food required for healthy eating; and, (iii) calorie intake of different food groups for each day (Basiotis et al. 2002; Goldberg et al, 2004; Boumtje et al, 2005). Focus is placed on what to eat and how much to eat, and also on the kind of activities that complement healthy eating behaviour. In general the information presented on the pyramid suggests large quantities of servings of rice and cereals, moderate servings of vegetables (leafy vegetables) and fruits,

meat and dairy products; and, occasional servings of fats, oils and sweets. Households are encouraged, therefore, to reduce the consumption of fats, oils and sugars; increase the consumption of fruits, vegetables and grains, but consume meats and dairy products less frequently than they consume fruits, grains and vegetables. In addition, household members are encouraged to exercise regularly.

It is generally acknowledged that poverty limits households' ability to meet their required calorie intake. In that regard, households in poverty are less likely to follow any prescribed national food guide. Studies on poverty have focused on food consumption and calorie intake of households (Glewwe, Gragnolati & Zaman, 2002) in the context of a prescribed national food guide. In these studies the number of kilocalories of food consumed (dietary energy intake) and the number of different food types (dietary diversity) are the key determinants of nutritional status. In addition, attention is given to factors that guide food choice. It is generally assumed that households will choose all the food guide groups. It is acknowledged in the literature that households in different continents, nations, societies and communities develop their own systems of guiding their food choices. However, in developing countries, these choices are often severely limited by the amount of food available. It is argued that the FGP only provides a good guide to good nutrition. In that regard, the FGP helps households acquire a visual mapping of their daily requirements of the quantity and nutritional value of food in each food pyramid group. Households are expected to customise their food choices by including those food items currently missing from their food choice set, and/or cutting back on the food items that they are over-indulging in. Adherence to the FGP implies, then, that calorie intake of households will depend on the number of food items chosen across the food guide groups.

What motivates this study, then? Why look at household food choices? Haughton (2000, p.75) argues that it is “puzzling that a household’s intake of Calories per capita does not appear to have an appreciable effect on malnutrition suggesting that more attention needs to be paid to the type of food eaten, ..., as well as the determinants of intra-household distribution of food”. Empirical evidence suggests that average diets differ considerably from the FGP recommendations (Young & Kantor 1999; Goldberg, et al. 2004), A positive association of poverty, obesity, declining health and increased consumption of fats, oils and sweets is evident in a range of studies (Burros 1992; Nguyen & Popkin, 2003b; Boumtje, et al. 2005). More-so, there is a gap between actual and required food intakes (McNamara, et al. 1999, Young & Kantor, 1999, Painter, Rah & Lee 2002), and the greatest relative gap occurs in fruits and dairy groups. Critiques have argued that the FGP reflects many political and economic interests of specific industry groups; and, therefore is unlikely to be effective in educating the public about nutrition (Burros 1992).

It is therefore of empirical significance to: (i) examine the determinants of the number of food items that households consume; (ii) examine factors that affect the number of food pyramid groups that household choose; and, (iii) identify factors that influence households to choose a full set of FGP food groups or part thereof; and, examine factors that influence per capita calorie intake and per capita expenditure, particularly the likely impact of the number of FGP food groups chosen, and food items consumed by households. A preliminary attempt is made, therefore, to answer the following research questions: How significant is food choice or diet diversity in determining per capita calorie intake in Vietnam? To what extent to Vietnamese households adhere to the Food Guide Pyramid guidelines? What are the key determinants of the extent of adherence to the pyramid? What factors affect household choice of any of the food groups on the FGP? The objectives of this research are, therefore, to: (i)

examine whether Vietnamese household food group consumption choices are consistent with dietary guidelines of the Food Guide Pyramid of the USDA; and, (ii) identify determinants of Vietnamese households' food group consumption choice, per capita expenditure and calorie intake. In this paper, adherence to the FGP is construed as: being able to select food items that cover all food pyramid groups. Adherence to the FGP is looked at only from the perspective of the number of food groups chosen. The amount of calories for each group, the number of servings in which class, and the frequency with which the servings are taken, are not considered

This study is significant in the following context. It is noteworthy that the VLSS92-93 was the first Living Standards Measurement Survey (LSMS) to be conducted in Vietnam. Blank and Grosh (1999) confirm that the goal of the VLSS was to generate a comprehensive dataset to help guide policy decisions being taken as part of the transition a market-based economy. The Vietnamese government has, however, used this data only minimally (Blank & Grosh 1999, p.216). One of the reasons suggested for apparent absence of policy application from the VLSS results is that there is a “yet little demand for data-driven policy analysis by the Vietnamese government” (Blank & Grosh 1999, p.216). It is anticipated that the results of this study will contribute to the growing supply of empirical evidence on nutrition and poverty that can be used to inform data driven policy analysis in Vietnam.

The paper is structured as follows: Following the introduction in Section 1, a brief literature review on Nutrition in Vietnam and internationally is presented in Section 2. Some key points that emerge from the general literature on nutrition are also presented. These points are used to identify key variables to consider in modeling Vietnamese FGP choices. The model, methods and data used in the study are presented in Section 3. Analyses and results are

reported in Section 4. Concluding remarks are drawn in Section 5. A list and description of variables used in the model is presented in the Appendix.

2: LITERATURE REVIEW

2.1 Nutrition in Vietnam

The economy of Vietnam grew rapidly between 1993 and 1998 and achieved the fourth largest growth in Gross Domestic Product (Haughton 2000, p.67; Nguyen & Popkin 2003b, p.254). It is therefore of significant research interest to find out the social and economic changes to Vietnamese households' nutrition during the periods of rapid growth (Haughton 2000, p.67), and during the transition phase in Vietnamese economic development.

Nutrition has long been a concern in Vietnam (Haughton & Haughton 1997, p.542, Haughton 2000), and improvement in nutritional status lags behind other health indicators despite the dramatic economic improvements (Nguyen, Berman & Larson 2002; Nguyen & Popkin 2003b). Low levels of nutrition have been found mainly in low income households, in ethnic minorities, and who reside in rural areas (Haughton, 2000; Glewwe, Gragnolati & Zaman 2002). Cultural differences are of significance when looking at nutrition in general in Vietnam. In order to improve levels of nutrition, the general advice to dietitians working with diverse cultural has been to “use the US Food Guide Pyramid as a food choice guide, in addition to emphasising cultural foods” (Painter, Rah & Lee 2002, p.489). Like most countries that have adopted the US Food Guide Pyramid as their own official guide (Painter, Rah & Lee 2002, p.483), Vietnam has a Food Guide Pyramid quite similar to the USDA FGP, and has promoted the Vietnamese Food Guide Pyramid extensively (VFGP). In spite of these efforts to address problems of nutrition in Vietnam, there are still disparities in nutrition across the country.

There is need, therefore, to examine the extent to which households adhere to any reference food pyramid guide or health eating guide and exhibit healthy eating behaviours as proxied by food group choice and per capita calorie intake, even though child malnutrition has fallen rapidly between 1992-93 and 1997-1998 (Haughton 2000, p.74; Nguyen & Popkin, 2003a), and Vietnam's decline in poverty is among the fastest ever experienced in the world (Nguyen & Popkin, 2003b). Since the FGP is a viable and relevant nutrition education tool, it is of significance, therefore, to provide an understanding of the choice of the number of food groups made by Vietnamese households.

2.2 Key Points from Literature on Nutrition

What are some of the stylized facts emerging from the literature? Although most countries have adopted the US Food Guide Pyramid as their own official guide (Painter, Rah & Lee 2002, p483), and made modifications that reflect country-specific food items and nutrient composition; these modified Food Guides have, however, not included imported food items. Most developing countries export a significant proportion of processed food. Diets of many Americans do not adhere to the dietary guidelines illustrated by the pyramid (Goldberg et al 2004). For some food groups the gap between actual and recommended food intakes is often too large (Young & Kantor 1999). In an effort to reflect differences in food availability, dietary patterns (food preferences), and cultural definitions of foods, an assortment of food guide pyramid graphics have been produced to reflect country-specific recommendations (Painter, Rah & Lee 2002, p.483). Despite the wide spectrum of graphics representing food guides, these guides display similar 'ideal dietary patterns'.

The literature also shows that the analysis of total expenditure, food expenditure, and calorie intake is of interest to food security analysts. Household surveys are used to provide detailed data for estimating Engel curves, demand systems and food consumption behaviour. In terms of estimating techniques, it is appropriate to use these household surveys to fit demand equations for nutrients (Huang 1996). An understanding of dietary intake may also provide an indication of the nature of intra-household distribution. It is also argued in the literature that household surveys enough data (information) to accord a comparison of food guidelines by looking at food grouping and recommended quantities for the food groups (Painter, Rah & Lee 2002, p.483).

In the literature the income variable is used to explain food choice and inform policy makers about the likely effects income transfers on nutrition (Haughton & Haughton 1997, p.544). Evidence also suggests that household levels of nutrition are affected by occupational status of household members (Glewwe, Gragnolati & Zaman 2002, p.780). Higher levels of education are often strongly associated with the welfare of individuals and households (Haughton & Haughton 1997, p.544; Croll, Neumark-Sztainer & Story 2001, p.2; Glewwe, Gragnolati & Zaman 2002, p.778). Rural residence, access to irrigated land, and consumption of home product, feature prominently in poverty studies determinants of poverty status (Haughton 2000, Glewwe, Gragnolati & Zaman 2002, p.784; Painter, Rah & Lee 2002, p.483).

3. THE MODEL, METHODS AND DATA

3.1 The Model and Methods

Two simple linear ordinary least squares (OLS) specifications are presented. The first OLS equation specification regresses the number of food items consumed by Vietnamese households on selected demographic, socioeconomic and regional regressors. The second OLS specification links the number food pyramid groups chosen by Vietnamese households, to a set of regressors. Two log-linear models are included to explain the observed levels of per capita expenditure, and per capita calorie intake. These log-linear models use a subset of the explanatory variables from the OLS estimations. In addition, the regressands in the OLS specifications are entered as regressors in the log-linear specifications. A binary logit model is also estimated for households choosing six the full set of FGP food groups. The binary logit model also incorporates demographic variables and regional characteristics. Five equation specifications are estimated, therefore; and all incorporate selected demographic and regional dummy variables. It significant to note that these five equations are estimated separately, and any results and conclusion drawn therefore are interpreted outside the context of a multiple equation systems incorporating endogenous discrete choice variables, as well as exogenously determined dummy variables.

The theoretical framework used for the linear model is as follows: The equation $y = x\beta + \epsilon$, where y is the number of food items consumed or the number of food pyramid groups chosen, and ϵ is error term. In the non-linear model the equation $y^* = x\beta + \epsilon$ is considered. In this case y^* is logarithm of per capita expenditure (in the expenditure equation), or the logarithm of per capita calorie intake (in the calorie equation). The explanatory variables x include continuous and dummy variables representing household characteristics.

The binary logit model is used to analyse household food choices in Vietnam. The following theoretical framework for the logit model is used. In the logit model formulation it is assumed that a latent variable (Z) determines the underlying latent variable model (Judge et al, 1982; Greene, 1993; Wooldridge, 2000; Gujarati, 2003; Murray, 2006). The latent unobservable variable in this case is the utility that households derive from the consumption of a complete or incomplete set of FGP food groups. In the binary case, the latent variable Z would represent, therefore, the difference in the utility derived from the two choices (consumption of a complete or incomplete set of goods). In this paper, the binary outcome of interest is selecting a full set of FGP food groups or selecting an incomplete set of FGP food groups. The expected value of the latent variable Z is then expressed in terms of parameters (β_j) and explanatory variables (\mathbf{x}) such that $Z_i = \beta_0 + \beta_1 x_1 + \dots + \beta_k x_k + \varepsilon_i$. The latent variable is the utility derived from choosing one of the two available sets of FGP food groups. The observed binary outcome (D_i) equals 1 if Z_i exceeds zero, and takes the value of 0 if Z_i is less or equal to zero (Wooldridge, 2000; Gujarati, 2003; Murray, 2006). In the paper, $D=0$ represents the choice of an incomplete set of FGP and $D=1$ represents the choice of a complete set of FGP groups. Interest lies in household choice of a full set of the FGP food groups ($D=1$) given a set of explanatory variables (\mathbf{x}). The relationship between the discrete choice dependent variable D and \mathbf{x} is shown in the form $(P(D=1|\mathbf{x}_i) = P(D=1|x_1, x_2, \dots, x_k))$. This relationship can be also be shown as the response probability $P(D=1|\mathbf{x}) = G(\beta_0 + \beta_1 x_1 + \dots + \beta_k x_k) = G(\beta_0 + \mathbf{x}\boldsymbol{\beta})$, where $\mathbf{x}\boldsymbol{\beta} = (\beta_0 + \beta_1 x_1 + \dots + \beta_k x_k)$ (Wooldridge, 2000; Murray, 2006). The function G is the standard logistic cumulative density function taking values ranging between 0 and 1, and is given by $G(\cdot) = \exp(z)/(1 + \exp(z))$, where D is the FGP choice variables, and \mathbf{x} the full set of explanatory variables that contain household characteristics.

The maximum likelihood estimation (MLE) method is used for estimating the logit model. The log-likelihood function for each observation is a function of the parameters and the given data, and is obtained as: $l_i(\beta_j) = D_i \log[G(x_i\beta_j)] + (1-D_i)\log[1 - G(x_i\beta_j)]$. Therefore, the log-likelihood for a sample of size n is obtained by $L(\beta) = \sum_{i=1}^n l_i(\beta)$. The MLE of β_j , denoted $\hat{\beta}_j$, maximises the log-likelihood, and the MLE of β_j is the logit estimator (Judge et al, 1982; Greene, 1993; Wooldridge, 2000; Gujarati, 2003; Murray, 2006). Of interest in the estimation of the response probability, $P(D=1|x) = G(\beta_0 + \mathbf{x}\beta)$, is explaining the partial effects of x_j on the response probability $P(D=1|x_j)$. The partial effects have the same sign as β_j (Wooldridge, 2006), and the sign of the coefficient β_j is therefore sufficient for determining whether the variables X has a positive or negative effect regardless of whether x_j is a dummy or a continuous variable. The coefficients give the signs of the partial effects of each x_j on the response probability. Each $\hat{\beta}_j$ has an asymptotic standard error and the hypothesis that $\beta_j = 0$ is tested using the t-statistic. Robust standard errors are reported alongside the coefficients odds-ratios, marginal effects and related diagnostic values. The null hypothesis ($H_0: \beta_j = 0$) is tested against the alternative ($H_1: \beta_j \neq 0$) is rejected. Selected diagnostic tests are also presented.

3.2 Data

Data from the Vietnamese Living Standards Survey (VLSS) covering periods 1992/93, 1997/98, 2002 and 2004 are examined. The data are organised as follows: The food groups considered in the analyses are breads and cereals; fruits, vegetables, meats; milk and milk products; fats, oils, drinks and sweets. In the absence of data on actual food servings, the research considers only food group choices, and the number of food items consumed. Estimates of calorific value are therefore included in the Vietnamese food consumption data.

Holiday consumption is excluded on the assumption that good nutrition is not a holiday event. Given the need for dietary diversity (variety), proportionality and moderation, it is therefore reasonable to exclude holiday food choices from the household consumption basket used when investigating the determinants of food choice. It is assumed, in this study that VLSS data captures daily behaviour adequately, and therefore consumption choices implied by the VLSS data are also daily household consumption choices.

Consistent with the literature, the continuous variables considered include the size of the household's food basket, per capita calorie intake, and per capita expenditure (income). Dummy variables used include ethnicity, female headship of household, poverty status and food group choice, to name a few. Of significance in the study is the use of the calorie-price to highlight the level of food insecurity. The full set of variables used in the study is presented in the Appendix.

4. ANALYSES AND RESULTS

The data are analysed using linear ordinary least squares (OLS) regressions, and binary logit analysis. Attention is focussed on the following: (i) identifying factors that influence the number of food items chosen; (ii) identifying factors that influence the number of FGP food groups chosen; (iii) identifying whether the number of FGP food groups or number of food items chosen by a households influences per capita calorie intake; (iv) investigating whether the number of FGP food groups or number of food items chosen by a households influences per capita expenditure; and (v) examining the determinants of the different combinations of FGP food groups that the households choose. The analyses for (i), (ii), (iii), and (iv) is done using OLS. The analysis for (v) is done using binary logit estimation.

The results reported in Table 1 show that a significantly large proportion of Vietnamese households selected bread, rice and pasta (max_g1), fruits (max_g2), vegetables (max_g3), and meat products (max_g4). The consumption of milk and milk products (max_g5) has increased steadily from a low of 11.94% in 1992/93 to 50.39% in 2004. The consumption of fats and oils (max_g6) has remained quite high. Beer consumption has increased modestly from 48.15% in 1992/93 to 69.83% in 2004. The proportion of households eating out has also increased from 28.75% to 76.25%. This is an increase of about three-fold.

Table 2 reports the proportion of households selecting a specified number of food groups from the pyramid. In a way, Table 2 reports the composition of diets off Vietnamese households. It is clear from Table 2 that a small proportion of diets consist of food items from three or less food groups. The proportion of diets composed from three or less food pyramid groups has remained steady over the period 1992-2004. In terms of household choices, this result is interpreted as following: some Vietnamese households are still choosing their food intake from three or less food groups. The proportion of households constructing their diets from any four food pyramid groups has decreased from 17.88% in 1992 to 4.76% in 2004. The drastic drop may suggest that households are choosing from more than four food pyramid groups, since the proportion of households choosing from three or less food groups has remained quite small. However, the proportion of households choosing from any five food pyramid groups has also declined from 68.98% to 45.31%; and, the proportion of households choosing the full set of the FGP has increased to around 50%.

TABLE 1: Proportion of Households Selecting FGP food groups and Other Foods

	Variable		1992/93	1997/98	2002	2004
FGP FOOD GROUPS^(a)						
1	Bread Cereals, Rice and Pasta	max_g1	99.88	99.85	99.81	99.85
2	Fruits	max_g2	80.71	93.50	90.34	94.43
3	Vegetables	max_g3	98.52	99.72	99.19	99.38
4	Meat, Fish, Dry Beans, Eggs and Nuts	max_g4	99.23	99.73	99.69	99.79
5	Milk , Yoghurt and Cheese	max_g5	11.94	27.70	40.56	50.39
6	Fats, Oils, Sweets and Drinks	max_g6	99.75	99.82	99.90	99.96
FOOD GUIDE PYRAMID						
	Full Set of FGP	FGP_set 1: Yes	11.59	27.54	39.58	49.57
	Incomplete set of FGP	FGP_set 0: Yes	84.41	72.46	60.42	50.43
OTHER FOOD ITEMS^(b)						
	Beer Consumption	max_beer	48.15	55.21	69.56	69.83
	Eating Out	max_eato	28.75	46.16	68.94	76.25

Notes:

- (a) The food groups labelled 1 through 6 are for the six FGP food groups, and are coded [0: No] & [1: Yes]
- (b) These items are not classified under the FGP, but have significant budget share implications, and are coded [0: No] & [1: Yes]

Table 2: Proportion of Households Selecting a Specific Number of Food Groups

num_groups	1992/93	1997/98	2002	2004
0	0.06	0.10	0.06	0.03
1	0.06	0.05	0.06	0.05
2	0.25	0.02	0.05	0.03
3	1.19	0.13	0.39	0.26
4	17.88	6.08	8.58	4.76
5	68.98	66.11	51.30	45.31
6	11.58	27.51	39.56	49.55
5 or 6	80.56	93.62	90.86	94.86

The results reported in Table 2 do not show what combinations of food groups were selected by the households. To show the various combinations chosen by Vietnamese households, focus is diverted to those choices of households selecting five or more food groups from the pyramid. This group of households consists of 80.56%, 93.62%, 90.86%, and 94.86% of households in the 1992/93, 1997/98, 2002, and 2004 surveys, respectively. Seven combinations are therefore possible, and they translate to: households missing none of the food groups (MNL=1) and for households consuming any five food groups (FGP_set=0), where MNL2=2 represents missing out on fats and oils (max_g6); MNL2=3 represents missing out on milk products (max_g5), MNL2=4 represents missing out on meat products (max_g4), MNL2=5 represents missing out on vegetables (max_g3), MNL2=6 represents missing out on fruits (max_g2), and MNL2=7 represents missing out on bread, and cereals (max_g1). These combinations, MNL1 through MNL7 are mutually exclusive, and are shown in Table 3, together with the proportions of households selecting these combinations for the period 1992-2004.

Table 3 reports the proportion of households missing selected food groups as well as those consuming the full set of FGP food groups. The results reported in Table 3 suggest a steady increase in the proportion of household selecting the fullest of FGP food groups. Fats and oils (max_g6) were only missing in the 1992/93 study. Vegetables (max_g3) were also missing in some household diets in 2002 and 2004. A large proportion of diets are missing milk and milk products (max_g5). The results reported in Tables 1 through 3 set the scene for interpreting the results in Table 4.

Table 3: Proportion of Households Missing Selected FGP Food Groups

FOOD GROUP MISSED		MNL	1992/93	1997/98	2002	2004
No Food Group Is Missing	FGP_set=1	1	14.38	29.39	43.54	52.24
Fats, Oils, Sweets and Drinks	max_g6=0	2	0.03	-	-	-
Milk , Yoghurt and Cheese	max_g5=0	3	85.21	70.42	55.45	46.94
Meat, Fish, Dry Beans, Eggs and Nuts	max_g4=0	4	-	-	0.00	-
Vegetables	max_g3=0	5	-	-	0.06	0.08
Fruits	max_g2=0	6	0.39	0.2	0.93	0.75
Bread Cereals, Rice and Pasta	max_g1=0	7	-	-	0.01	-

In Table 4, determinants of the number of food groups (max_fc) chosen by households. In other words, the dependent variable (max_fc) represents the basket of food items used in a household's diet. Results show that households choosing the full complement of the FGP (that is FGP_set=1) are more likely to have a larger basket of food items (max_fc) to choose from. Increased per capita calorie intake (log_pcci), calorie price (calorie_price), and the incidence of food poverty (fpl_poor=1), and rural residence (urban=0) tend to decrease the

size of the basket of food items (max_fc). An increase in the size of the consumption basket (max_fc) is associated with increased incomes (log_pce), the incidence of eating out ($\text{max_eato}=1$), beer consumption ($\text{max_beer}=1$) and household size (hhsiz). In addition, an increase in the size of the food basket is more likely to occur in female-headed households ($\text{F_head}=1$). The ethnic dummy (kinh) suggests that larger food baskets (max_fc) are more likely to be enjoyed by the majority ethnic groups ($\text{kinh}=1$). Other ethnic groups ($\text{kinh}=0$) might be experiencing smaller food baskets (max_fc).

A similar interpretation of the results in Table 4 can be made when examining the key determinants of the number of food pyramid groups chosen (num_groups). Higher per capita expenditure (log_pce), ethnicity ($\text{kinh}=1$), female headship of household ($\text{F_head}=1$) and household size (hhsiz) tend to be associated with an increase in the number of food groups (num_groups). The number of groups chosen (num_groups) seems to decline for households in rural residences ($\text{urban}=0$), paying higher calorie prices (calorie_price), having low calorie intake (log_pcci), with significant consumption of beer ($\text{max_beer}=1$) and eating out ($\text{max_eato}=1$).

Table 4: Determinants of Food Choice, Calorie Intake and Expenditure in 2002

Variable	(max_fc)	(num_groups)	(log_pcci)	(log_pce)
num_groups	-	-	0.04 ^(a)	0.05 ^(a)
max_fc	-	0.05 ^(a)	-	-
max_beer	4.73 ^(a)	-0.13 ^(a)	0.23 ^(a)	-0.67 ^(a)
max_eato	3.63 ^(a)	-0.04 ^(a)	0.08 ^(a)	0.10 ^(a)
FGP_set	6.94 ^(a)		-0.80 ^(a)	0.05 ^(a)
log_pcci	-0.27 ^(b)	-0.12 ^(a)	-	0.18 ^(a)
calorie_price	-89.94 ^(a)	-13.41 ^(a)	-31.29 ^(a)	19.44 ^(a)
log_pce	4.44 ^(a)	0.10 ^(a)	0.38 ^(a)	-
fpl_poor	-0.94 ^(a)	-0.01	-0.09 ^(a)	-0.53 ^(a)
kinh	2.45 ^(a)	0.06 ^(a)	-0.22 ^(a)	0.06 ^(a)
redriver	4.07 ^(a)	-0.16 ^(a)	-0.07 ^(a)	-0.24 ^(a)
northeast	1.16 ^(a)	-0.07 ^(a)	0.01	-0.04 ^(a)
northwest	-0.24	-0.05 ^(a)	0.03 ^(b)	-0.03 ^(a)
northcentral	1.89 ^(a)	-0.10 ^(a)	0.00 ^(a)	-0.09 ^(a)
southcentral	1.16 ^(a)	0.03 ^(b)	-0.05 ^(a)	-0.07 ^(a)
centralhigh	1.19 ^(a)	0.07 ^(b)	0.06 ^(a)	-0.09 ^(a)
southeast	0.34 ^(b)	0.05 ^(a)	-0.51 ^(a)	0.08 ^(a)
F_head	0.37 ^(a)	0.02 ^(b)	-0.23 ^(a)	0.04 ^(a)
hhszise	0.46 ^(a)	0.02 ^(a)	-	-
urban	-1.12 ^(a)	-0.04 ^(a)	0.16 ^(a)	-2.78 ^(a)
constant	-12.09	4.93	11.62	5.17
F	1825	1209	801	2564
Prob > F	0.00	0.00	0.00	0.00
R-squared	0.53	0.42	0.32	0.60
Adj R-squared	0.53	0.42	0.32	0.60
RMSE	5.93	0.50	0.43	0.29

Notes:

(a) coefficients are significant at the 1% level

(b) coefficients are significant at the 5% level

Household's calorie intake (log_pcci) decreases with increases in calorie price (calorie_price), and in female-headed households. Income (log_pce) tends to boost calorie intake. These results are all statistically significant at the 1% level. The choice of a full set of FGP food groups (FGP_set=1) explains increases in the size of the food basket (max_fc), and has a negative impact on per capital calorie consumption. This is an interesting result.

Table 5 presents these coefficient estimates, robust standard errors of the odds-ratios and marginal effects, and the statistical significance thereof. Results reported in Table 5 show that increasing the number of food items purchased increases the likelihood of selecting the full set of FGP food groups. This result shows the importance of a larger dietary diversity in meeting the USDA Food Pyramid Guidelines. An increase in beer consumption, however, lowers the likelihood of consuming the complete set of FGP food groups.

The results show that a larger number of β_j coefficients are statistically different from zero. The chi-square statistic that tests the significance of the null hypothesis that all estimated β_j coefficients are equal to zero is statistically significant at the 1% level. The null hypothesis that all β_j coefficients are zero is, therefore, rejected. The likelihood ratio (LR) is statistically significant at the 1% level. The values of the marginal effects show that if a household increases per capita expenditure by 1%, then the marginal effect is a decrease of 0.1176% in the probability of choosing a full set of FGP groups. Negative marginal effects are also reported for households in urban areas, with increased per capita expenditure, eating out and beer consumption. Positive marginal effects are reported for: (i) increasing the number of food items, (ii) increasing per capita calorie intake, and (iii) for households that are food-poor or are headed by females. Murray (2006) notes that the statistical insignificance of intercept in a logit model corresponds to a probability of 0.50 in the reference variable, when the explanatory variable is zero. In the results presented in Table 5, the intercept is statistically significant at the one percent level. It is noteworthy that the use of the per capita expenditure (\log_pce) and per capita calorie intake (\log_pcci), as explanatory variables in the logit model, raises endogeneity issues.

The results in Table 5 also present evidence on the key determinants of the pyramid choices. Using a binary logit model with dependent variable FGP_set (FGP_set=0 and FGP_set=1), the results show that households with a significant consumption of beer (max_beer=1), and a tendency to eat out (max_eat=1) are more likely to choose an incomplete set of FGP food groups (FGP_set=0). It is noteworthy that the coefficient of female household headship is positive and statistically significant. Interestingly, food poor households (that is, households below the food poverty line – fpl_poor=1) are more likely to select from a full set of FGP groups. Higher incomes (log_pce) tend to promote the choosing of an incomplete set of FGP groups. The diagnostics show that the models are statistically significant at the 5 per cent level.

Table 5: Results of Logit Analysis of Food Group Choices in Vietnam in 2002

Explanatory Variable	Regression coefficients	odds-ratio	Robust standard errors	Marginal effects
max_fc	0.19 ^(a)	1.21 ^(a)	0.0033	0.0445 ^(a)
max_beer	-0.67 ^(a)	0.51 ^(a)	0.1957	-0.1586 ^(a)
max_eato	-0.26 ^(a)	0.77 ^(a)	0.0297	-0.0614 ^(a)
log_pcci	0.16 ^(a)	1.18 ^(a)	0.0629	0.3762 ^(a)
log_calorie_price	1.39 ^(a)	4.03 ^(a)	0.3683	0.3203 ^(a)
log_pce	-0.51 ^(a)	0.60 ^(a)	0.0513	-0.1176 ^(a)
fpl_poor	0.21 ^(a)	1.23 ^(a)	0.0682	0.0498 ^(a)
Kinh	0.07	1.07	0.0585	0.0150
Redriver	-0.67 ^(a)	0.51 ^(a)	0.0250	-0.1440 ^(a)
Northeast	0.01	1.01	0.0563	0.0026 ^(a)
Northwest	-0.15	0.86	0.0866	-0.3285
Northcentral	-0.10	0.90	0.0528	-0.0237
Southcentral	0.24 ^(a)	1.27	0.0736	0.0572
Centralhigh	0.42 ^(a)	1.52 ^(a)	0.1095	0.1007
Southeast	0.40 ^(a)	1.50 ^(a)	0.0796	0.0968
F_head	0.09 ^(b)	1.09 ^(b)	0.0417	0.0210 ^(b)
Urban	-0.15 ^(a)	0.86 ^(a)	0.0350	-0.0347 ^(a)
Constant	4.55 ^(a)			
DIAGNOSTICS				
No. of observations	29507			
Wald chi2 (17)	7584.22			
Prob > chi2	0.0000			
LR chi2	12018			
Prob > chi2	0.00			
Pseudo R2	0.31			

Notes:

- (a) coefficients are significant at the 1% level
- (b) coefficients are significant at the 5% level

5. CONCLUDING REMARKS

The analyses of VLSS data conducted in this study suggests that a significant proportion of households are choosing food items across all six food groups of the USDA Food Guide Pyramid (FGP). The proportion of households selecting food items that make the full set of the FGP has increased since 1992. The full set of FGP was chosen by households with smaller household sizes, higher incomes, higher level of education, and by households across all VLSS regions in Vietnam. The impact of the ethnic minority dummy variable in determining food choice is noticeable. As seen from the results, the share of eating out has increased significantly and diet diversity has changed slightly. This result suggests a significant shift in aspects of Vietnamese economic life.

Although, income affects the size of household baskets (max_fc), the number of food groups covered (num_foods), per capita calorie intake (log_pcci), and the likelihood of choosing a full set of food pyramid groups (FGP-set); the results also suggest that poorer households are making every effort to consume the full set of the FGP choices. Limitations in income and food availability place constraints on how much calorie intake is available, within households' current means of sustenance.

The results lend support to the general use of the food guide pyramid, and highlights the significance of examine the size of food baskets and food groups covered. Probably of significance would be to re-examine the current food baskets and assessing where the largest gains in calorie intake are likely to come from. It is of importance to consider the contribution of eating out to total calorie intake, as well as per capita calorie intake. It is worth noting that, depending on family composition, the distribution of calories from eating out could be as important to food poverty as calorie distribution from eating at home. An increase in the

budget share of eating out limits the share expenditure available for other food items. The negative impact of significant eating out (especially that directed to a limited number of family members) is likely to be more pronounced in larger families.

Poor households are likely to gain from any policies that improve income, promote home production of food, as long as substitution to low calorie food is curtailed or contained. Any public education programs or campaigns aimed at nutrition awareness and promoting adherence to the Food Guide Pyramid must look at nutrient composition of indigenous and imported food items. In addition, efforts must be placed in disseminating nutrition knowledge in a way that easy to implement across all ethnic groups. This is particularly important given Vietnam's cultural diversity.

It is hoped that the analysis undertaken in this paper, using the VLSS household survey, contributes to the suite of approaches used to assess food insecurity and vulnerability, and informs policy adequately. In particular, the focus on nutrients in the context of the Food Guide Pyramid should provide a unique and interesting baseline for looking at nutrient elasticities in Vietnam.

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APPENDIX: VARIABLES USED IN THE STUDY

Description of Variable:	Variable Name	Classification
Number of food pyramid groups	(num_groups)	
Number of food items consumed	(max_fc)	
Beer Consumption	(max_beer)	[0] No; [1] Yes
Eating Out	(max_eato)	[0] No; [1] Yes
Chose Food Guide Pyramid Set	(FGP_set)	[0] No; [1] Yes
Per capita Calorie intake	(log_pcci)	
Calorie Price	(calorie_price)	
Per capita expenditure	(log_pce)	
Food Poverty Status	(fpl_poor)	[0] Not Poor; [1] Yes Poor
Ethnicity	(kinh)	[0] non-Kinh; [1] Kinh
RedRiver Delta	(redriver)	[0] No; [1] Yes
North East	(northeast)	[0] No; [1] Yes
North West	(northwest)	[0] No; [1] Yes
North Central	(northcentral)	[0] No; [1] Yes
South Central	(southcentral)	[0] No; [1] Yes
Central High	(centralhigh)	[0] No; [1] Yes
South East	(southeast)	[0] No; [1] Yes
Female Headed Household	(F_head)	[0] No; [1] Yes
Household Size	(hhsized)	
Residence	(urban)	[0] rural [1] urban
Breads, Cereals, Rice and Pasta	(max_g1)	[0] No; [1] Yes
Fruits	(max_g2)	[0] No; [1] Yes
Vegetables	(max_g3)	[0] No; [1] Yes
Meat, Fish, Dry Beans, Eggs and Nuts	(max_g4)	[0] No; [1] Yes
Milk, Yoghurt and Cheese	(max_g5)	[0] No; [1] Yes
Fats, Oils, Sweets and Drinks	(max_g6)	[0] No; [1] Yes
Unique Combination of FGP groups	(MNL)	[1, 2, 3, ..., 7]

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