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**Dietary Pattern, Calorie Intake and Undernourishment:
The Vietnamese Experience**

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Abstract

Vietnam's recent economic performance on a wide range of monetary indicators has been impressive. The rate of poverty reduction in Vietnam during the 1990s is second only to that of China. This study attempts to go beyond the picture portrayed by the poverty figures and studies the changes in the extent of undernourishment in Vietnam during this period. It uses the information contained in the two Vietnamese Living Standard Surveys from the 1990s and finds that the picture on undernourishment is nowhere as impressive. This paper exploits the panel nature of the data to construct transition matrices that compare the nutritional status of the households between 1992/93 and 1997/98. These show that a significant minority of the 4302 households were unable to move out of their state of undernourishment. A comparison with the poverty rate based transition matrices confirms what the aggregate figures suggest, namely, that there is considerable dissonance between the picture on food expenditure poverty and that on undernourishment. The study, also, performs panel regressions to identify some of the key determinants of undernourishment with a view to providing the profile of a household that is at greatest risk from undernourishment.

Keywords: Prevalence of Undernourishment, Panel Regression,
 Food Diversity, Transition Matrix

JEL Classification: D12, I12, O18, O53

1. Introduction

Vietnam's economic progress in the 1990s, both in terms of macro aggregates such as growth rate and inflation, and in terms of welfare indicators such as improvement in living standards and poverty reduction, has been impressive.¹ Following its emergence from a long period of colonial rule and social and economic devastation caused by war, the country showed little progress in the 1980s. With an annual inflation rate of 487% in 1986, a large government deficit, very low rate of economic growth and a high poverty rate, Vietnam was regarded as a "basket case" in the mid 1980s and in urgent need of policy initiatives to stem its decline. Such initiatives came in the form of the "Doi-Moi" ("renovation") policy reforms in the late 1980s. This consisted of a set of important policy changes starting with the agricultural sector and extending to government spending, trade, investment, health and education. What followed is an incredible success story. In the period from the late 1980s to the second half of the 1990s, Vietnam witnessed a dramatic increase in its living standards. With the head count poverty rate halving from 75% to 37% over the period 1992/93 – 1997/98, Vietnam's record on poverty reduction was one of the most impressive among the Asian countries, second only to that of China [see World Bank (2000)].

This has sparked considerable interest among economists in the Vietnamese experience in the 1990s. Examples include World Bank (2000), Balisacan, et.al. (2003), White and Masset (2003), Tung (nd), Lovendel (2004), Glewwe, et.al. (2004) and Molini (2006). The recent empirical literature on Vietnam was, largely, made possible by two Vietnam Living Standard Surveys (VLSS) that were carried out in 1992/93 and 1997/98. While a large part of this literature used expenditure based poverty measures, there has been relatively less attention paid to the dietary pattern and, even less, to food security, calorie

¹ See the introductory essay (Ch. 1) by P. Glewwe in the volume edited by Glewwe, Agarwal and Dollar (2004) for an overview of Vietnam's economic experience in the 1990s.

intake and undernourishment in Vietnam. A significant exception is the recent study by Molini (2006) which throws light on the issue of food security in Vietnam in the 1990s.

The present study provides evidence on the related issues of dietary habits, food security, calorie intake and undernourishment in Vietnam during a period of significant economic change. It's key distinctive features include the following:

- (i) The emphasis of this empirical investigation is on nutritional deprivation and under nutrition rather than expenditure poverty. The link between the two is examined by comparing the calorie based “prevalence of undernourishment” (POU) rate with the traditional expenditure based poverty rate (POV). As the Indian evidence presented in Ray and Lancaster (2005) and Ray (2006) show, POU and POV do not always move in tandem and, sometimes, can even have contradictory trends. Given Vietnam's impressive record on poverty reduction (POV) during the 1990s, it is interesting to examine, as this study does, if that record extends to calorie deprivation or undernourishment (POU) as well.
- (ii) In departing from the traditional emphasis on money metric measures based on income or expenditure, the present study is in the spirit of Sen [1999, Ch. 4] who argues that “poverty must be seen as the deprivation of basic capabilities rather than merely as lowness of incomes, which is the standard criterion of identification of poverty” (p. 87). Since calorie deprivation and entitlement failures can arise from inadequate calorie intake, the results of this study have considerable policy significance, especially in the context of development. The Vietnamese evidence, reported later, that the POU rate generally and often by a large margin, exceeds the POV rate, is consistent with Sen's argument that one needs to look beyond the traditional money metric measures in examining the magnitude of deprivation. The importance of Sen's argument is, also, underlined by the Vietnamese evidence of Baulch and Masset (2002) who found that monetary poverty is less persistent than malnutrition among adults, stunting among children and primary and lower secondary school enrolments.
- (iii) This study exploits the panel nature of the data. It tracks the households that are common to both surveys, and calculates the proportion of such households that have not changed their undernourishment/poverty status over the period, 1992/93 – 1997/98, and those that have. The analysis combines the matrices showing the alternative states of undernourishment and poverty into one that shows the agreement/disagreement between the two measures. The study performs and reports the sensitivity of the POU and POV measures to assumptions on calorie requirement and on equivalence scales and economies of household size, respectively.
- (iv) In its final phase, the study performs panel estimation of a household's calorie intake, relative to its requirement, on a set of regional, ethnic and household characteristics with a view to portraying the profile of a household that is most at risk from undernourishment. The panel estimation is followed by the multivariate ordered logit

estimation of the alternative combinations² of the household's nutritional status in the two surveys. The exercise identifies the attributes that have strong and significant effects in altering the household's nutritional experience from a least preferred combination towards the most preferred one.

The rest of the paper is organised as follows. Section 2 describes the two VLSS data sets and compares the dietary pattern and their calorie implications in the two surveys. The POU rates, along with the sensitivity exercises, are reported in Section 3. Section 4 reports and discusses the transition matrices that show the changes or otherwise in the nutritional (POU) and food poverty (POV) status of the households between the two VLSS data sets. The panel and multivariate ordered logit estimations are reported and discussed in Section 5. The results are summarised and possible directions for further research indicated in the concluding Section 6.

2. Data Sources and Dietary Changes in Vietnam

The present study is based on the two Vietnamese Living Standard Surveys (VLSS) that were carried out in 1992/93 and in 1997/98. Both these surveys spanned a full year. While the 1992/93 survey began in October, 1992, the 1997/98 survey started in December, 1997. These surveys were part of the Living Standards Measurement Study (LSMS) household surveys that were conducted in a number of developing countries with technical assistance from the World Bank.³ The present study is based on the household unit records on food expenses and home production that are contained in Section 11 of the household questionnaire. As explained in World Bank (2001), the two surveys are comparable for the purposes of this study since their household questionnaires differed only marginally with respect to the questions on food purchases. The VLSS, 1992/93 data set involved 4800

² The 4 alternative possibilities, arranged in a welfare improving sequence, are: (a) the household is undernourished in both periods, (ii) nourished in period 1, undernourished in period 2 (iii) undernourished in period 1, nourished in period 2, (iv) nourished in both periods.

³ See World Bank (2001) for a detailed description of these two VLSS data sets.

households, while the VLSS, 1997/98 data set involved 6000 households.⁴ Approximately 4300 households in the first survey were reinterviewed in the second survey providing us with a panel of 4302 households. All the calculations reported later are based on this panel.

This study utilises the quantity and expenditure information on the purchases of 45 food items which were collected separately for the Tet and other holiday periods, and the rest of the year. The surveys took into account food consumption out of self production by valuing them at market prices. The 10-item food classification, obtained by aggregating the original list of 45 items, is given in Appendix Table A1. The quantities consumed were converted into calorie intake by, first, transforming all units into kilos [see Appendix Table A2] and, then, applying the FAO conversion factors [see Appendix Table A3] used recently by Molini (2006).⁵ Following Molini's study, we overlook the possibility of calorie wastage due to inefficient cooking methods and, in the absence of information, assumed that all the purchased calories are consumed by the household.

This study required the Vietnamese food poverty lines for the two years and the age/gender specific minimum calorie requirements for the calculation and comparison of the rates of POU (prevalence of undernutrition) and POV (household poverty). In calculating the POV rate, the household's per capita food expenditure was converted to national VND figures by using the price deflators for 1992/93 and 1997/98 that have been calculated by Vietnam's GSO.⁶ A household is considered "food expenditure poor" or "food insecure" if its per capita/per adult equivalent annual food expenditure falls below VND 749, 723 in 1993 and VND 1,286,833 in 1998.⁷ Following White and Masset (2003), the sensitivity of the POV rate calculations to the assumed values of the equivalence scale and economies of

⁴ This included 1200 households who were selected from the 1995 Multi-Purpose Household Survey (MPHS) conducted by Vietnam's General Statistical Office (GSO).

⁵ We are grateful to Vasco Molini for informing us of the FAO website (www.fao.org/docvcp) that contains this information.

⁶ These have been reported in, respectively, Balisacan, et.al. (2003, Appendix Table A1) and in World Bank (2001, Appenidx Table D2).

⁷ See Tung (nd) for an explanation of how these poverty lines were arrived at.

household size was examined and is reported later in the paper. The POU rate was calculated using the age and gender specific minimum calorie requirements recommended by WHO (1985). A household is, then, considered to be “undernourished” if its aggregate calorie intake is less than its minimum calorie requirement that is calculated taking account of its age and gender composition. The POU is, then, simply the household level head count rate of undernourishment, calculated analogously to the head count rate of food poverty (POV). The POU measure has been used extensively by the FAO in world wide calculations of hunger [FAO (1992)]⁸ and in the case of individual countries and regions [Harris (1990), Osmani (1992) and Ray (2006)].

Table 1 reports the region wise changes in the budget share of food between the two surveys. Consistent with Engel’s law and the overall improvement in living standards in Vietnam, over the period 1992/93-1997/98, there was a decline in the budget share of food, with some areas (e.g. the urban sector of the North Central region) registering a large decline. Table 2 reports the changes in the per capita consumption of the Food items and in the expenditure composition of the Food basket for Vietnam as a whole by presenting the share of the Food constituents. The expenditure share of Rice, Fish and Vegetables declined, while that of Fruits and Meats increased in both rural and urban areas. The large shift from Rice to Fruits, Meat and the miscellaneous smaller items grouped under “Other items” suggest a diversification of the Vietnamese diet over this period.

The movement in the composition of Food consumption is reflected in Table 3 which reports the calorie share of the Food items in the total calorie intake of the household. Table 3 shows large regional variation both in the magnitude of the calorie shares and in their changes over this period. In many cases, though not everywhere, the calorie share of Rice fell, while that of “Other items” increased over this period. An interesting result, that holds

⁸ See, however, Svedberg (2000) for a critique of the FAO method of measuring under nutrition.

generally, is that the calorie importance of Vegetables fell over this period. A striking feature of the Vietnamese diet, that is apparent from this table, is the high concentration of the calorie source with nearly 90% of the calorie intake coming from just 3 items, namely, Rice, Vegetables and Meat. In contrast, these 3 items supply less than 50% of the calories in the Indian diet [see Ray (2006)]. This observation is of some policy significance in view of a possible link between dietary diversity and food security. As Hoddinott and Yohannes (2002) concluded from their study on a data set from 10 countries, “a 1 percent increase in dietary diversity is associated with a 1 per cent increase in per capita consumption, a 0.7 per cent increase in per capita calorie availability.....” (p. iii). Molini’s (2006) study has also drawn attention to this issue by observing that in Vietnam “poor households.....still lack vitamins, iron, calcium, etc.” in their diet.

3. Prevalence of Undernourishment in Vietnam

Table 4 presents the POU estimates of the percentage of Vietnamese households that are unable to meet their daily minimum calorie requirements. Svedberg (2000) points out that the POU estimates can be wildly sensitive to the a priori specified minimum calorie requirements. Rao (2005) argues that, due to a variety of reasons, the calorie requirements have declined over the years. The POU estimates, presented in Table 4 have, therefore, been calculated at the original WHO (1985) specified calorie requirements, and at 80% and 60% of the recommended minimum calorie levels. It is clear that there is, generally, a high prevalence of undernourishment in Vietnam. The POU rates fall to poverty rate (POV) magnitudes only if we reduce the minimum calorie requirements by as much as 20%. Another significant feature of Table 4 is that, over the period 1992/93 – 1997/98, Vietnam’s performance on reducing the incidence of undernourishment is not as impressive as her well known record on poverty reduction. The POU rate has generally remained stagnant, or has

even increased slightly, and shows an appreciable decline in some of the rural areas only at 60% of the original calorie requirement.

To explore the reason for the divergence between Vietnam's record on poverty reduction and undernourishment, we calculated the median price of calorie and of food. The latter was calculated as an expenditure share weighted average of the median prices of the 4 major food items, namely, Rice, Meat, Fish and Fruits. Table 5 compares the two sets of price indices in 1997/98, with 1992/93 as the base year. The calorie price inflation has exceeded the food price inflation in almost all cases. This reflects a shift in the pattern of food consumption from items which are sources of cheap calories to more expensive ones. This result is consistent with Molini's (2006) "evidence of a substitution of poor micro nutrient items (rice and cereals) with rich ones like fruit, vegetables, fish and meat". If more expensive calories mean that they are of superior "quality", then the calorie requirements need to be adjusted downwards over time. In that case, Vietnam's record on undernutrition looks much better, comparable to her creditable record on poverty reduction. There is scope for further research on the scientifically acceptable rate of downward adjustment, if any, to the calorie requirements over time.

4. Changes to Nutritional and Poverty Status Over Time

Table 6 presents the transition matrix of the nutritional status of the panel of 4302 households over the period 1992/93 – 1997/98. In keeping with the above discussion, the table reports the calculations at the original levels and at 80% of the WHO recommended minimum calorie requirements. The top half of Table 6 shows that a large majority (72.5%) of the households remained undernourished throughout this period, while a much smaller group (9.69%) saw an improvement from their status of under nourishment in 1992/93. Another result of significant policy concern is that a significant minority of households

(13.25%) saw a worsening of their nutritional status from being adequately nourished in 1992/93 to becoming under nourished in 1997/98. The picture does improve significantly in the second half of the table with the lowering of the calorie requirement in the second period by 20% but, even here, nearly half the panel of households (43.37%) remained under nourished over this period.

Table 7 presents the corresponding transition matrix of the food poverty status of the households under alternative assumptions on the size-scale relativities. While the top segment of this table corresponds to the case where the uncorrected household size is used as the food expenditure deflator, the middle and bottom segments correspond, respectively, to the use of $(n_a + 0.65n_c)$ and $(n_a + 0.65n_c)^{0.85}$ as the deflators, where n_a, n_c are, respectively, the number of adults and the number of children (aged 15 years or less) in the household. The adoption of these particular values of the equivalence scale for a child (0.65) and economies of household size (0.15) were guided by their use in a recent study on Vietnam [White and Masset (2003)]. An alternative approach would be to estimate these values from this data but such an attempt⁹ would have taken us far beyond the objective of this exercise. Also, as pointed out in the working paper version of White and Masset (2003), “working with arbitrary, but commonly accepted values, is often adequate it is certainly sufficient for our main point of the importance of these adjustments for the poverty profile”. Such a point, namely, the sensitivity of the overall food poverty rate and the elements of the transition matrix to the size-scale relativities is clearly established by Table 7. While Vietnam’s impressive record on food poverty reduction during this period is, qualitatively, robust to the choice of the expenditure deflator, the magnitude of poverty decreases with the introduction of adult child relativity in the middle segment of Table 7, and declines further and more sharply with the introduction of household size economies in the bottom segment of that table. Note, however, that, as White

⁹ See Lancaster, Ray and Valenzuela (1999) for such an exercise on cross country data.

and Masset (2003) found for Vietnam, this hides significant differences between various sections of the population. For example, such adjustments can lead to a rise in the poverty of rural households, those with little education, minority ethnic groups and female headed households.¹⁰

A result of some significance, that the transition matrices in Table 7 establish, is that a significant minority of households in the panel (29.59% in the absence of size economies and adult child relativity) failed to cross the food poverty line and remained poor throughout this period. However, the situation improves with the introduction of size economies and adult/child relativity with the balance of household numbers shifting in favour of households which did cross the food poverty line from below. A comparison of the top segments of Tables 6 and 7, neither of which involves any adjustment, shows that not only does the picture on undernourishment look decidedly worse than that on food poverty but, more significantly, a much greater proportion of the households were unable to alter their undernourishment status than the proportion that remained below the food poverty line over this period.

Table 8 allows a more direct comparison between food poverty and undernutrition by providing a breakdown, separately for 1992/93 and 1997/98, between the 4 alternative states that a household can find itself in. The offdiagonal elements in each matrix show the percentage of households whose status differs between under nourishment and food poverty. Consistent with the earlier discussion, a much greater proportion of households is under nourished but food secure (i.e. $D < 0$, $P > 0$) than the other way round (i.e. $D > 0$, $P < 0$). The magnitude of the former group of households, i.e. food secure but undernourished, went up sharply over this period (60.62% in 1992/93 to 71.45% in 1997/98). An important caveat to

¹⁰ See Meenakshi and Ray (2002) for similar evidence for India, with female headed households facing higher poverty rates once household size economies are allowed in the calculations.

this result is that the situation may look somewhat better if we make a downward adjustment to the calorie requirements over this period.

5. The Determinants of Undernutrition in Vietnam

This section builds on the previous discussion by performing panel estimation of the difference (D) between a household's calorie intake and its minimum calorie requirement on a selection of regional, community and household characteristics. The random effects estimates¹¹ are presented in Table 9. The regional dummy coefficients are significant in some cases, though not always. In relation to the residents of the Mekong river delta, which is the reference region, those in the Northern Uplands and the Red River delta are better nourished, while those living in the Central Coast do a lot worse. The ethnic dummy coefficients show significant differences between the various ethnic groups. In relation to the smaller ethnic communities, which are grouped together as "others" and adopted as the reference group, the majority Kinh community and the Chinese fare badly, while members of the Tay community are relatively well nourished. The time coefficient shows a small, but statistically insignificant, improvement in nutrition over this period. The urban household is better nourished than the rural, while the female headed household fares significantly worse than the male headed. While the commodity price movements and changes in the relative prices did not have much of an impact, an increase in the calorie price had a large and statistically significant on calorie intake. The large and highly significant positive coefficient of the per capita expenditure variable shows that, *ceteris paribus*, richer households do enjoy superior nutritional status.

The educational level of the household head, acting as a proxy for the literary level of the household, does not have a significant impact on nutrition – if anything, it appears to have

¹¹ The fixed effects estimates are available on request.

a perverse effect. The outcome of this discussion is to paint alternative profiles of a household that is at risk from under nutrition – for example, a female headed, rural household belonging to the Chinese community residing in a village which has witnessed a high rate of calorie price inflation.

Table 10 presents the ordered logit estimates (with standard errors) of the panel, where the outcomes are ordered in the following sequence of increasing welfare. The household is: (i) undernourished in both periods, (ii) nourished in period 1, undernourished in period 2, (iii) undernourished in period 1, nourished in period 2 and (iv) nourished in both periods.¹² A significant positive coefficient estimate indicates that the attribute helps to push the household towards the most preferred state, and a significant negative coefficient estimate indicates the reverse. The results mirror those in Table 9 and help to put the evidence in clearer policy perspective. The residents of the Northern Uplands and Red River delta, members of the Khmer community, urban households and the more affluent households are among those who have performed relatively well on nutritional grounds during this period. Another group of households that appears to have done well, possibly because of their lower calorie requirement, has been the female headed households.

6. Summary and Conclusion

Following an indifferent performance in the late 1970s and the first half of the 1980s, Vietnam undertook a series of policy reforms that, by all accounts, led to a sharp rise in living standards and a steep decline in household poverty during the 1990s. This is now well documented in the recent literature on Vietnam which is, largely, based on two Vietnamese Living Standard Surveys conducted in 1992/93 and 1997/98. Much of the evidence on declining poverty is based on the expenditure poverty rates. This paper attempts to extend

¹² The marginal effects (with the standard errors) of the four outcomes are available on request.

these findings by looking at the picture on undernourishment by calculating the “prevalence of undernourishment” (POU) and comparing it with the traditional poverty rates (POV). This study exploits the panel nature of the VLSS data sets and tracks the nutritional and poverty status of the panel of 4302 households over the period between the two surveys, namely, between 1992/93 and 1997/98. In addition, this exercise attempts to identify some of the key determinants of undernourishment and, in the process, provides the possible profile of a household that is most at risk from undernourishment.

The principal conclusion of this study is that Vietnam’s performance on the reduction of undernourishment does not look as impressive as her widely acknowledged, successful record on poverty reduction during the 1990s. One has to lower the household’s calorie requirements by as much as 40% to see any significant reductions in the POU rates and, that too, in selected areas. The calculations, reported in the transition matrices, show that, on the original calorie requirements recommended by WHO (1985), nearly 72.5% of the panel of households remained stuck in a state of undernourishment over this period. This figure drops if one reduces the calorie requirement by 20% but, even on this lower calorie norm, nearly half (43.37%) the panel failed to transit out of the state of undernourishment. Another point of concern is the result that a significant minority of households (13.25%) fell into undernourishment over this period.

Many would argue that much of this movement in the POU rates is voluntary reflecting a shift in food preferences from items such as Rice, which are sources of cheap calories to items such as Fruits and Meat, which are more expensive sources of calories. The results of this study provide some evidence for this and, hence, finds that the calorie inflation has tended to outstrip food price inflation calculated from unit values. However, whether voluntary or not, the comparison of the POU rates presents a less optimistic picture than that portrayed by the POV rates. This is consistent with other recent evidence on Vietnam [Baulch

and Masset (2002), Molini (2006)]. The fact that the POU and POV rates do not move in tandem and that the food expenditure poverty rates are generally sharply lower than the rate of undernourishment is consistent with the Indian evidence presented in Ray (2006). Another similarity between the Vietnamese and the Indian results is that a far greater percentage of households are undernourished but appear “food secure” because they are above the food expenditure poverty line than the other way round. These households need to be specially targeted for policy intervention.

Another feature of the results of this study is the high degree of concentration of calorie supply in the Vietnamese food diet with nearly 90% of the calories being provided by just three items, namely, Rice, Vegetables and Meat. This study also provides some evidence of diversification in calorie sources over this period. However, in comparison with other Asian countries such as India, the Vietnamese calorie intake is still very highly concentrated making the Vietnamese household particularly vulnerable to the price movement within a narrow band of food items. This is of significant policy concern especially in view of some recent findings, referred to in the paper, that a lack of diversity in food diet may be associated with low levels of calorie intake. There is clearly a need for the adoption of policies that will encourage diversification of the Vietnamese food diet and reduce the consumer’s dependence on a very select group of food items.

The overall message of this study is that one needs to look beyond the monetary measures to evaluate the household living standards in countries, such as Vietnam, which have undergone significant policy reforms. While the existing VLSS data sets do provide some information on health, etc., they do not go far enough. With these living standard surveys now being carried out on a regular basis, and the 2002 and 2004 VLSS data sets about to become available, the results of this exercise point to the need for more information in areas such as nutrition, morbidity, etc. in future VLSS questionnaires. This will allow the

policy analyst to target households such as those who show evidence of being stuck in a state of permanent undernourishment. The transition matrices, reported in this paper, suggest that the number of such households may not be negligible. One needs to extend these calculations to construct transition matrices on other dimensions. The policy maker needs the whole picture based on a wide range of both monetary and non monetary indicators before devising a comprehensive strategy to increase household welfare. That, clearly, is a matter for further research.

Table1: Changes in Budget Share (%) of Food Between 1992/93 and 1997/98^(a)

Region	Rural			Urban		
	1992/93	1997/98	Change (%)	1992/93	1997/98	Change (%)
1. Northern Uplands	73.39	66.83	-8.94	59.52	50.67	-14.87
2. Red River delta	68.05	61.51	-9.61	51.53	49.52	-3.90
3. North Central	67.34	61.21	-9.10	58.95	49.20	-16.54
4. Central Coast	62.10	60.41	-2.72	48.80	50.79	4.08
5. Central Highlands	64.02	57.61	-10.01	-(b)	-	-
6. Southeast	58.96	55.89	-5.21	48.56	45.27	-6.78
7. Mekong River delta	57.43	57.32	-0.19	52.79	48.53	-8.07

(a) Source: Authors' calculations.

(b) None in the panel resided in the urban area of the Central Highlands.

Table 2: Per Capita Consumption (Kg./Month) of Food Items and their Shares of Food Expenditure

Food Item	Per Capita Consumption (Kg./month)					
	Rural			Urban		
	1992/93	1997/98	Change (%)	1992/93	1997/98	Change (%)
Rice	13.44	13.39	-0.45	11.12	10.59	-4.77
Wheat	0.13	0.21	61.54	0.65	0.56	-13.85
Other Cereals	0.75	0.75	0.00	0.66	0.89	34.85
Vegetables	5.69	4.07	-28.47	4.30	3.95	-8.14
Fruits	1.19	1.43	20.17	2.10	1.91	-9.05
Meats	0.54	0.92	70.37	1.20	1.51	25.83
Fish	0.91	1.07	17.58	1.35	1.23	-8.89
Dairy	0.01	0.05	400.00	0.06	0.19	216.67
Beverages	0.44	0.54	22.73	0.44	0.47	6.82
Other Items	0.61	0.55	-9.84	0.57	0.56	-1.75
	Share of total Food Expenditure (%)					
	1992/93	1997/98	Change (%)	1992/93	1997/98	Change (%)
Rice	55.32	49.41	-10.68	33.65	28.36	-15.72
Wheat	1.54	1.75	13.64	4.39	3.33	-24.15
Other Cereals	3.57	3.25	-8.96	2.90	2.91	0.34
Vegetables	6.89	6.17	-10.45	5.95	5.79	-2.69
Fruits	2.20	2.89	31.36	3.82	4.21	10.21
Meats	11.41	15.77	38.21	18.99	20.20	6.37
Fish	10.41	10.04	-3.55	11.83	10.31	-12.85
Dairy	0.83	0.70	-15.66	1.18	1.58	33.90
Beverages	3.36	3.54	5.36	3.11	3.45	10.93
Other Items	4.45	6.46	45.17	14.14	19.82	40.17

Table 3: Share (%) of Calories From Various Food Items

RURAL																				
	Rice		Wheat		Other Cereals		Vegetables		Fruits		Meats		Fish		Dairy		Beverages		Other Items	
	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98
1. Northern Uplands	76.8	81.9	0.3	0.7	9.8	7.1	7.5	3.0	0.6	0.8	2.2	2.9	0.4	0.5	0.00	0.24	1.64	2.13	0.66	0.69
2. Red River delta	86.8	83.6	0.2	0.8	3.4	4.3	4.6	2.5	0.7	1.1	1.8	3.6	0.4	0.6	0.00	0.21	1.17	1.92	0.80	1.28
3. North Central	83.5	80.7	0.3	1.2	3.1	4.9	7.3	3.8	0.6	1.2	1.5	3.1	0.8	0.9	0.00	0.58	1.98	2.34	0.93	1.17
4. Central Coast	84.5	83.4	0.8	0.9	3.4	3.4	5.3	4.5	0.8	1.0	1.3	2.7	1.2	1.1	0.02	0.31	1.06	1.56	1.47	1.23
5. Central Highlands	84.6	87.0	1.1	0.8	5.6	2.2	3.3	1.2	1.1	0.6	1.5	3.4	0.8	1.1	0.01	0.19	0.93	2.79	0.90	0.68
6. South East	83.6	81.5	2.4	1.8	3.7	3.2	2.6	1.8	1.1	1.4	2.4	4.1	1.2	1.5	0.03	0.40	1.30	1.46	1.54	2.92
7. Mekong River delta	86.3	85.8	0.9	0.9	1.8	1.2	2.2	1.4	1.2	1.0	2.6	3.7	1.4	1.4	0.01	0.19	1.48	1.42	1.91	2.92
URBAN																				
	Rice		Wheat		Other Cereals		Vegetables		Fruits		Meats		Fish		Dairy		Beverages		Other Items	
	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98	1992/93	1997/98
1. Northern Uplands	83.0	78.9	1.4	2.7	4.7	5.4	2.7	1.9	0.9	1.1	3.8	5.6	0.4	0.4	0.00	0.43	1.43	2.11	1.54	1.46
2. Red River delta	74.1	71.4	3.6	3.8	4.4	5.9	2.1	2.5	1.7	2.0	7.1	7.2	0.8	0.9	0.04	0.95	3.89	3.45	2.19	1.92
3. North Central	84.2	76.0	1.1	3.9	4.9	5.7	2.6	1.8	0.8	1.4	2.8	6.2	0.6	0.8	0.04	0.69	1.62	2.16	1.19	1.20
4. Central Coast	81.1	76.1	4.5	2.9	2.1	4.4	1.8	2.4	2.0	1.9	3.0	4.7	2.2	2.1	0.04	1.05	0.88	1.94	2.34	2.32
5. Central Highlands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6. South East	73.5	73.4	4.7	3.1	3.5	4.5	2.6	2.2	3.4	2.1	5.9	7.3	1.4	1.3	0.2	0.56	1.70	2.1	2.94	3.48
7. Mekong River delta	78.3	79.9	4.2	2.0	2.6	2.1	2.3	1.8	1.9	1.3	5.2	6.3	1.7	1.6	0.08	0.25	0.92	0.92	2.72	3.95

Table 4: The Percentage of Households that are Undernourished: POU Rates

Based on (Actual Calories < Required Calories) Criterion									
Region	Rural			Urban			Overall (All Vietnam)		
	1992/93	1997/98	Change (%)	1992/93	1997/98	Change (%)	1992/93	1997/98	Change (%)
Northern Uplands	76.12	77.01	1.17	84.11	86.92	3.34	77.37	78.44	1.38
Red River delta	78.72	79.11	0.50	88.27	87.76	-0.58	80.21	81.21	1.25
North	89.45	84.98	-5.00	76.56	93.75	22.45	88.11	85.67	-2.77
Central	82.62	91.88	11.21	92.13	94.23	2.28	85.03	92.61	8.91
Coast	77.39	87.83	13.49	-	-	-	77.39	87.83	13.49
Highlands	80.07	89.51	11.79	95.00	96.32	1.39	85.71	92.23	7.61
South East	80.48	88.26	9.67	84.52	94.05	11.28	81.26	89.37	9.98
Mekong River delta	80.82	84.07	4.02	88.11	92.05	4.47	82.19	85.75	4.33
Overall									
Based on (Actual Calories < 0.8* Required Calories) Criterion									
Northern Uplands	34.60	31.65	-8.53	43.93	45.79	4.23	36.06	33.69	-6.57
Red River delta	33.18	35.44	6.81	67.90	56.54	-16.73	38.61	40.55	5.02
North	57.64	47.53	-17.54	42.19	43.75	3.70	56.03	47.23	-15.71
Central	57.22	55.07	-3.76	75.59	74.36	-1.63	61.88	61.08	-1.29
Coast	40.00	43.48	8.70	-	-	-	40.00	43.48	8.70
Highlands	49.32	56.64	14.84	85.56	83.16	-2.81	63.03	67.23	6.66
South East	45.40	54.60	20.26	59.52	75.00	26.01	48.11	58.51	21.62
Mekong River delta	43.90	44.79	2.03	66.09	67.66	2.38	48.07	49.40	2.77
Overall									
Based on (Actual Calories < 0.6* Required Calories) Criterion									
Northern Uplands	6.75	4.09	-39.41	10.28	11.21	9.05	7.30	5.12	-29.86
Red River delta	5.03	5.93	17.89	18.52	20.25	9.34	7.14	9.40	31.65
North	12.91	7.07	-45.24	14.06	10.42	-25.89	13.03	7.33	-43.75
Central	22.19	12.46	-43.85	36.22	35.26	-2.65	25.75	19.56	-24.04
Coast	9.57	6.09	-36.36	-	-	-	9.57	6.09	-36.36
Highlands	19.59	18.18	-7.20	55.56	54.21	-2.43	33.19	32.56	-1.90
South East	14.57	15.70	7.76	30.95	32.14	3.84	17.71	18.86	6.49
Mekong River delta	11.71	9.51	-18.79	30.69	30.57	-0.39	15.27	13.95	-8.64
Overall									

Table 5: Median Price of Calorie and Food^(a) in 1997/98^(b) (1992/3 = 1.0)

Region	Rural		Urban	
	Calorie	Food	Calorie	Food
1. Northern Uplands	1.85	1.72	1.99	1.88
2. Red River delta	2.02	1.80	1.68	1.58
3. North Central	1.93	1.85	2.46	2.24
4. Central Coast	1.95	1.80	2.17	1.93
5. Central Highlands	2.00	2.13	-	-
6. South East	2.20	2.01	1.79	1.87
7. Mekong River delta	1.97	2.02	1.95	1.87

(a) The median Food price index was calculated as a share weighted average of the median unit values of Rice, Meat, Fish and Fruits.

(b) Source: Authors' calculations.

Table 6: Transition Matrix of Nutritional Status Between 1992/93 and 1997/98^{(a),(b)}

A. Based on WHO recommended minimum calorie requirement		
	D < 0 in 1993	D > 0 in 1993
D < 0 in 1998	72.50% (3119) ^(c)	13.25% (570)
D > 0 in 1998	9.69% (417)	4.56% (196)
B. Based on a downward adjustment (20%) to the calorie requirement in 1997/98		
	D < 0 in 1993	D > 0 in 1993
D < 0 in 1998	43.37% (1866)	6.02% (259)
D > 0 in 1998	38.82% (1670)	11.78% (507)

(a) $D = \text{Total calories consumed} - \text{Required minimum calorie intake}$.

(b) The elements in the matrix denote the percentage of households satisfying the corresponding sequence of nutritional status in the two periods.

(c) The numbers in brackets denote the number of households.

Table 7: Transition Matrix of Food Poverty Status Between 1992/93 and 1997/98 Under Alternative Values of Equivalence Scale and Household Size Economies.^{(a),(b)}

A. Using household size as the food expenditure deflator		
	P < 0 in 1993	P > 0 in 1993
P < 0 in 1998	29.59% (1273) ^(c)	16.25% (699)
P > 0 in 1998	20.89% (899)	33.26% (1431)
B. Using (No. of adults + 0.65* No. of children) as the deflator		
	P < 0 in 1993	P > 0 in 1993
P < 0 in 1998	18.47% (795)	13.76% (592)
P > 0 in 1998	22.13% (952)	45.63% (1963)
C. Using (No. of adults + 0.65* No. of children)^{0.85} as the deflator		
	P < 0 in 1993	P > 0 in 1993
P < 0 in 1998	7.11% (306)	7.46% (321)
P > 0 in 1998	16.27% (700)	69.15% (29.75)

(a) P = Per capita food expenditure – per capita food poverty line.

(b) The elements in the matrix denote the percentage of households satisfying the corresponding sequence in the two periods.

(c) The numbers in brackets denote the number of households.

Table 8: Breakdown (%) of Households based on a combination of Nutritional (D) and Food Poverty (P) Status

1992/93		
	D < 0	D > 0
P^(b) < 0	22.18% (954)	1.21% (52)
P > 0	60.02% (2582)	16.60% (714)
1997/98		
	D < 0	D > 0
P < 0	15.25% (615)	0.28% (12)
P > 0	71.45% (3074)	13.97% (601)

(a) Numbers in brackets denote the number of households.

(b) In calculating P, the food expenditure deflator was set at: (No. of adults + 0.65 No. of children)^{0.85}

Table 9: Random Effects Estimates^(a) of Panel Regression: Dependent Variable, D^(b)

Variable	Co-efficient Estimate	Standard Error
<u>Regional Dummies^(c)</u>		
Northern Uplands	638.00 ^(f)	115.23
Red River delta	404.95 ^(f)	97.50
North Central	76.10	110.44
Central Coast	-403.23 ^(f)	115.96
Central Highlands	216.29	218.87
South East	-69.53	124.62
<u>Ethnic Dummies^(d)</u>		
Kinh	-362.66 ^(e)	181.65
Tay	635.21 ^(e)	271.61
Chinese	-1496.29 ^(f)	305.26
Khmer	590.28 ^(e)	294.25
Muong	178.31	273.95
Nung	233.60	301.82
Gia-rai	422.73	278.82
<u>Other Dummies</u>		
Time Dummy	391.44	374.58
Urban Dummy	632.75	105.96
Female Headed Household	-191.41 ^(f)	71.37
<u>Other Characteristics</u>		
Rice price	0.08	0.09
Meat price	0.004	0.02
Fish price	0.01	0.02
Fruit price	0.03	0.03
No. of adults	-784.51 ^(f)	20.78
No. of children	-554.48 ^(f)	20.87
Education level of household head	-42.19	27.65
Calorie price	-956.84 ^(f)	70.13
Per capita expenditure	0.28	0.02
$\chi^2_{25} = 3501.91^{(f)}$, No. of observations = 8604, $\sigma_u = 947.22$, $\sigma_e = 2436.58$, ρ (fraction of variance due to u_i) = 0.1313.		

- (a) The panel estimation was performed using STATA
(b) D = Actual Calorie Intake – Required Calorie Intake
(c) Mekong river delta is the numeraire or base region
(d) The ethnic composition of the panel of 4302 households is as follows: Kinh (85.68%), Tay (2.17%), Chinese (1.82%), Khmer (1.80%), Muong (2.06%), Nung (1.66%), Gia-rai (1.50%) and Others (3.30%); the last category (i.e. “Others”) is the numeraire or base ethnic category.
(e) Statistically significant at 5%.
(f) Statistically significant at 1%.

Table 10: Estimates of Ordered^(a) Logit Regression

Variable	Co-efficient Estimate	Standard Error
<u>Regional Dummies^(b)</u>		
Northern Uplands	0.51 ^(e)	0.09
Red River delta	0.29 ^(e)	0.08
North Central	-0.06	0.10
Central Coast	-0.25 ^(d)	0.10
Central Highlands	0.07	0.18
South East	0.08	0.11
<u>Ethnic Dummies^(c)</u>		
Kinh	-0.43 ^(e)	0.14
Tay	0.28	0.20
Chinese	-1.46 ^(e)	0.40
Khmer	0.47 ^(d)	0.22
Muong	-0.30	0.20
Nung	0.16	0.22
Gia-rai	0.10	0.23
<u>Other Dummies</u>		
Time Dummy	0.06	0.34
Urban Dummy	0.40 ^(e)	0.10
Female Headed Household	0.19 ^(e)	0.06
<u>Other Characteristics</u>		
Rice price	-0.0001	0.0001
Meat price	0.00005 ^(d)	0.00002
Fish price	-0.00	0.00
Fruit price	0.00	0.00
No. of adults	-0.12 ^(e)	0.02
No. of children	-0.24 ^(e)	0.02
Education level of household head	-0.04	0.02
Calorie price	-0.77 ^(e)	0.08
Per capita household Expenditure	0.0002 ^(e)	0.00001
No. of observations = 8604, $\chi^2_{25} = 859.16^{(e)}$, Pseudo R ² = 0.0575.		

- (a) The ordered outcomes are as follows: D<0 in 1993, D<0 in 1998 (y=0), D>0 in 1993, D<0 in 1998 (y=1), D<0 in 1993, D>0 in 1998 (y=2) and D>0 in 1993, D>0 in 1998 (y=3).
- (b) Mekong river delta is the numeraire or base region
- (c) The ethnic category called “Others” is the base category.
- (d) Statistically significant at 5%.
- (e) Statistically significant at 1%

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Appendix:**Table A1: Composition of the Food Items**

S.No.	Item	Includes
1.	Rice	Ordinary rice, sticky rice, fresh rice noodles
2.	Wheat	Bread, wheat or wheat flour, wheat/egg noodle (dry)
3.	Other Cereals	Corn/maize (weight of kernels), barley, malt, millet, kaoling, arrow root noodles, beans, peanuts, sesame seeds, tofu
4.	Vegetables	Cassava (fresh equivalent), sweet and ordinary potatoes (fresh equivalent), water morning glory, kohlrabi, cabbage, tomatoes, other vegetables (calabash, pumpkin)
5.	Fruits	Oranges, bananas, mangoes, other fruit (rambutan, papaya, melon)
6.	Meats	Pork meat (inedible parts), beef and buffalo meat (inedible parts removed), chicken, duck and other poultry, other meats (goat, lamb, game meats, birds), processed meat
7.	Fish	Fresh fish, shrimp, dried and processed fish, other seafood (crab, snails, etc.)
8.	Dairy	Milk and other milk products, cake, candy, candied fruit
9.	Beverages	Alcohol and beer, coffee, tea, beverages (made with industrial methods)
10.	Others	Salt, sugar, molasses, food and drink away from home (breakfast, lunch), other

Table A2: Conversion Factors of Non Kilo Units into Kg

S. No.	Amount assumed equal to 1 Kg
1.	1 litre of rice
2.	4 pieces of corn/maize
3.	1 litre lard cooking oil
4.	10 pieces of tofu
5.	1 litre of beans
6.	5 pieces of tomato
7.	1 pumpkin
8.	4 oranges
9.	6 bananas
10.	3 mangoes
11.	1 papaya
12.	1 litre of salt, sugar, milk and alcoholic beverages

Table A3: Conversion factor table that was used to convert the quantities consumed to Kilo Calories

Food Code	Description	Kcal per 100 gm Item as purchased
301	Ordinary rice	357
302	Sticky rice	276
303	Corn/Maize (weight of kernels)	356
304	Cassava (fresh equivalent)	109
305	Sweet and ordinary potatoes (fresh equivalent)	76
306	Barley, Malt, Millet, Kaoling	332
307	Break, wheat or wheat flour	334
308	Wheat/egg noodle (dry)	213
309	Fresh rice noodles	360
310	Arrow root noodles	364
311	Pork meat (inedible parts)	220
312	Beef and buffalo meat (inedible parts removed)	150
313	Chicken	122
314	Duck and other poultry	291
315	Other meats (goat, lamb, game meats, birds)	263
316	Processed meat	233
317	Lard cooking oil	902
318	Fresh fish, shrimp	42
319	Dried and processed fish	161
320	Other seafood (crab, snails, etc.)	66
321	Chicken or duck eggs	139
322	Tofu	219
323	Peanuts, sesame seeds	573
324	Beans	341
325	Water morning glory	30
326	Kohlrabi	23
327	Cabbage	19
328	Tomatoes	17
329	Other vegetables (calabash, pumpkin)	19
330	Oranges	34
331	Bananas	60
332	Mangoes	45
333	Other fruit (rambutan, papaya, melon)	17
334	Fish sauce and dipping sauce	100
335	Salt	2
336	MSG	170
337	Sugar, molasses	387
338	Cake, candy, candied fruit	460
339	Milk and other milk products	61
340	Alcohol and beer	295
341	Coffee	56
342	Tea	40
343	Beverages (made with industrial methods)	39
344	Food and drink away from home (breakfast, lunch)	41
345	Other	170

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