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Food Security in Vietnam during the 1990s

The Empirical Evidence

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Abstract

Analysing the performance of ten developing countries, Hoddinot and Yohannes (2002) find a strong association between two measures of food security (calorie intake and mostly dietary diversity) and the increase in expenditures per capita. Using various indicators of food security, we describe the changes in food balances in Vietnam and find evidence of a substitution of poor micronutrients items (rice and cereals) with rich ones like fruit, vegetables fish and meat. Poor households, while increasing the amount of calories consumed, still lack vitamins, iron, calcium, etc. A preliminary assessment of the food security variation showed that improvements were, as expected, more concentrated among the richer Vietnamese households than the poor ones, although there was some improvement among poorer strata as well. We also focus on the calorie/expenditure elasticity and compare results for the years 1993 and 1998. Our findings confirm that this link is strong, and show that calorie income elasticity changed in the expected direction. We conclude that in general food security improved in Vietnam during 1990s although considerable differences still remain among expenditure deciles and among regions due to the accentuated spatial difference.

Keywords: food security, calorie consumption, Vietnam

JEL classification: I31, O15, Q18

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1 Introduction

Food security is one of the targets of the Millennium Development Goals and is widely considered a useful measure for evaluating the progress of a country in terms of wellbeing. According to the definition of USAID (1992), we have food security when 'all people all the times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life'.

After a long debate during 1990s, it is now commonly accepted that wellbeing is multidimensional and that the conventional measures or indexes that are based only on household expenditures miss many aspects. In several recent studies (Palmer-Jones and Sen 2001), the use of purely monetary-based indicators has been combined with non-monetary measures and the results compared in order to assess the phenomena in a more multidimensional way. The results of a non-monetary approach helps to understand the deeper mechanisms that are often overlooked by conventional analysis but which generally are extremely useful in examining poverty dynamics (vulnerability, persistence, etc.).

The use of food security indicators—a broad set of multidimensional measures—moves in this direction by providing useful tools to check the robustness of the findings. To observe relevant improvements in terms of wellbeing, we should see comparable food security improvements. For example, Hoddinott and Yohannes (2002), in analysing the performance of ten developing countries, find a strong association between two measures of food security (calorie intake and dietary diversity) and the increase in expenditures per capita.

Until now, few scholars have analysed the food security issue in Vietnam (Minot and Goletti 2000). Although there is a conspicuous literature on poverty reduction (Baulch and Minot 2004; Baulch and Masset 2003; Fritzen 2003, *inter alia*), what is missing in particular is a contribution that focuses on the potential food security improvements that occurred in the 1990s.

Given that the economic performance of Vietnam was astonishing during 1990s (on average over 7 per cent, World Bank 2004) and that the poverty ratio dropped from 58.1 to 37.4 (WB 2004), this study attempts to determine whether a similar pattern existed in terms of food security. Given the purpose of our paper and the nature of the data, we attempt to conduct a diachronic analysis of food security, as most of the literature has focused on static/cross countries comparisons, except for a few cases (Skoufias 2003 on Indonesia).

The paper is organized as follows. Sections 2 and 3 provide a general overview on data and present the tabulations on the price of food per calorie and the calorie share. Section 4 calculates some food security measures and then compares the results among the expenditure deciles and regions while section 6 provides the empirical results.

2 Data

The present analysis is based on the Vietnamese Living Standard Surveys (VLSS) of 1993 and 1998 and, in particular, on section 11 regarding food and non-food consumption. The two questionnaires differed only marginally and for 1998 we have

information on approximately 4,200 households of 4,800 households interviewed in 1993. Both rounds of surveys ask for data from households on the consumption of 45 different items during a 12-month period preceding the interviews. To take into account specific expenditure patterns unique to Vietnam, information on food items is collected separately for the holiday periods (notably the *Tet* holidays) and the rest of the year. The *Tet* holidays induce a considerable departure from normal spending.

As a major quantity of foodstuff consumed by rural households comes from self-production, respondents were asked for evaluate such consumption as if it were purchased in the market. To obtain annual totals, it is therefore necessary evaluate both expenditures for food from the *Tet*-period and subsistence production, and correspondingly scale down the normal purchases for the rest of the year. Assuming that the *Tet* and holiday periods cover 2 weeks, the 12-month purchases and subsistence production are multiplied by 11.5/12. We follow a similar procedure for the calorie equivalence. Instead of using values, we transform all quantities into kilos, converting these into calories according to FAO's conversion table. The procedure has certain shortcomings, as the result is not calorie intake but calorie availability (Deaton 1997). In the event of wastage due to inefficient cooking methods, real calorie consumption could be overstated dramatically, but as the data did not provide sufficient information on cooking methods, we assume that the purchased calories are also consumed.

For meals taken outside the home, we preliminarily adopt the Subramanian and Deaton (1996) strategy of using the average price of calories from the remaining data plus adding a 50 per cent premium to reflect processing margins. However, for many households eating a considerable number of meals outside the home (households with workers or agricultural labourers working beyond their own land plots), this results in a great underestimation of consumed calories. After several checks and comparing the expenditure data, we decided to use a 'median 1000 calories price'. This is calculated using the household prices per 1000 calories of almost every item, except alcoholic beverages and condensed milk, the most expensive articles and the less likely to be included in a normal meal. We then divide the expenditures for meals outside the home by this price and thus obtain the consumed calories.

Out of 100,000 observations, data on quantities were missing in about 1000 cases, while values were available. Thus in these instances, the question arose as to what price should be used to evaluate the consumption of these food items: (i) average or median prices calculated from the survey data for other households, (ii) prices from the price (community) questionnaire, or (iii) prices from some other external source? Using the procedure proposed by Deaton and Zaidi (2002) to obtain the quantity consumed, we divide the value of purchase/production by the price of the item prevailing in the cluster/ the commune, etc., depending on whichever is the next highest level of aggregation for the price information available. As an indicator of income, we use total household expenditures per capita deflated with a regional price index. The distribution of the two expenditures is fully comparable and the price index is based on 1998 prices.

Some observations were dropped: households having an estimated caloric intake below 1000 kilocalories per person per day or above 4000 were eliminated. This is based on the notion that these figures reflect problems in the consumption data (Minot and Goletti 2000). This reduced the 1993 sample to 4530 observation (out of 4800), the 1998 survey to 5846 (out of 6000) and the panel to 3934 for each year (instead of 4153).

3 Calorie price, food substitution and dietary composition

In Table 1, we calculate the median prices for the purchase of 1000 calories of any specific food category. As expected, rice provides 1000 calories at the lowest price, followed by pulses and legumes. Rice is the main item consumed by Vietnamese households and its calorie content for 100 grams is particularly high (360 kc for regular and 380 kc for glutinous). Similar to Deaton's find in the Maharashtran case (1997), we observe an increase in the cost of calories between the poor and richer segments of the population, but also a difference between the prices paid within the same broad food category. Poorer households (bottom 10 per cent in the table) seem to consume lower-quality items within all food categories; consequently, calorie prices paid by this group are below the mean and far below those paid by richer households (the top 10 per cent).

This is particularly evident in the case of rice in 1998. Compared to 1993, the difference in the price paid by the top 10 per cent increased in comparison to the bottom deciles, suggesting that more rice qualities were available in 1998 than in 1993 and that rich households tended to buy higher-quality items. This is consistent with other contributions (World Bank 2004) analysing the effect of price liberalization on supply diversification.

As suggested by Skoufias (2003), we calculate the relative prices of food items using the mean price of rice as a benchmark. Exploiting the panel nature of the data, we can in fact analyse the relative price variations and determine whether they affect the expenditure elasticity of any commodity demand.

Relative prices changed considerably during the 1990s under price liberalization. Improvements in infrastructure and transportation intensified the exchange, and enabled a greater variety of commodities to reach to all parts of the country. On the demand side, diversification also increased. The combination of both factors, thus, influenced price setting.

The relative price of typical rice substitutes like roots and tubers and other cereals declined, particularly for the bottom ten deciles. Items like cassava, sweet potatoes, rich in calories but less rich in micronutrients and vitamins, are in general in demand only in very poor households. The decline in relative prices and the corresponding drop in calorie shares (Table 2) might be interpreted as a good signal: poor households used expenditure improvements not only to increase their daily calorie intake (Table 4) but also to improve its nutritional value.

In contrast, the relative prices of micronutrient-rich items, except milk and fish, in general tended to increase (Table 1). There is, nevertheless, some variation due to expenditure levels and residential areas. Fish prices increased less from the 1993 and 1998 levels than meat prices. Compared to rice, fish prices became more favourable for poor households, thanks to augmented output and the fact that fish was relatively more expensive for rich households. Milk, on the other hand, became relatively more favourable for the rich households. Prices for low-quality rice substitutes depreciated while meat, milk, fruits and vegetables appreciated. Tables 2 and 3 give the share of calories provided by each food category.

Table 1
Prices per calorie, 1993 and 1998

				Price relative to cereals		
	Mean	Bottom 10%	Top 10%	Mean	Bottom 10%	Top 10%
	1993 survey					
Rice	592	565	633	1	1	1
Other cereals	1597	1415	1939	2.7	2.5	3.1
Roots & tubers	2001	1412	2728	3.4	2.5	4.3
Pulses and legumes	1899	1740	2512	3.2	3.1	4.0
Dairy products and eggs	7303	6943	7593	12.3	12.3	12.0
Meat and offal	5729	4897	7999	9.7	8.7	12.6
Fish and seafood	6197	5251	8480	10.5	9.3	13.4
Oils and fats	1050	1117	1043	1.8	2.0	1.6
Sugar and honey	1303	1195	1572	2.2	2.1	2.5
Fruits	1666	963	3279	2.8	1.7	5.2
Vegetables	4469	3340	7086	7.5	5.9	11.2
Beverages	25105	18121	33542	42.4	32.1	53.0
Processed food	3610	2877	4387	6.1	5.1	6.9
Other food	2548	2148	3583	4.3	3.8	5.7
Total	5286	3909	6338			
	1998 survey					
Rice	1021	983	1147	1	1	1
Other cereals	1929	1542	2423	1.9	1.6	2.1
Roots and tubers	2365	1286	4239	2.3	1.3	3.7
Pulses and legumes	2786	2524	3357	2.7	2.6	2.9
Dairy products and eggs	25112	23745	22732	24.6	24.2	19.8
Meat and offal	10838	9495	14221	10.6	9.7	12.4
Fish and seafood	7745	6084	13523	7.6	6.2	11.8
Oils and fats	1215	1217	1441	1.2	1.2	1.3
Sugar and honey	2369	2073	2982	2.3	2.1	2.6
Fruits	4224	1904	8046	4.1	1.9	7.0
Vegetables	6940	5376	9654	6.8	5.5	8.4
Beverages	39914	26546	55046	39.1	27.0	48.0
Processed food	5750	5098	7113	5.6	5.2	6.2
Other food	4578	3474	6947	4.5	3.5	6.1
Total	8629	6562	11054			

Source: Author's calculations using VLSS 1993 and 1998.

Table 2
Food calorie shares, 1993 and 1998

	1993			1998		
Products	Mean	Bottom 10%	Top 10%	Mean	Bottom 10%	Top 10%
Rice	0.75	0.81	0.53	0.69	0.78	0.47
Cereals	0.03	0.04	0.06	0.04	0.05	0.06
Roots and tubers	0.02	0.05	0.00	0.02	0.05	0.01
Pulses and legumes	0.01	0.01	0.02	0.02	0.01	0.02
Dairy products and eggs	0.00	0.00	0.01	0.00	0.00	0.01
Meat and offal	0.04	0.02	0.08	0.04	0.02	0.06
Fish and seafood	0.02	0.01	0.03	0.04	0.02	0.04
Oils and fats	0.02	0.01	0.03	0.04	0.02	0.04
Sugar and honey	0.02	0.01	0.05	0.02	0.01	0.04
Fruits	0.03	0.02	0.06	0.04	0.02	0.05
Vegetables	0.01	0.01	0.01	0.02	0.01	0.02
Beverages	0.01	0.01	0.02	0.02	0.01	0.03
Processed food	0.06	0.01	0.12	0.08	0.02	0.15
Other food	0.01	0.00	0.02	0.01	0.00	0.02

Source: Author's calculations using VLSS 1993 and 1998.

Table 3
Food calories shares, 1993 and 1998

Products	NU	RR	NC	SC	CH	HCM	MD
Rice	0.76	0.79	0.79	0.74	0.78	0.67	0.73
Cereals	0.04	0.02	0.01	0.04	0.03	0.05	0.03
Roots and tubers	0.03	0.02	0.04	0.02	0.01	0.01	0.01
Pulses and legumes	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Dairy products and eggs	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Meat and offal	0.04	0.04	0.03	0.03	0.02	0.05	0.04
Fish and seafood	0.01	0.01	0.02	0.03	0.02	0.03	0.03
Oils and fats	0.00	0.01	0.01	0.03	0.02	0.04	0.02
Sugar and honey	0.01	0.02	0.02	0.03	0.02	0.03	0.03
Fruits	0.03	0.03	0.02	0.04	0.05	0.03	0.05
Vegetables	0.01	0.02	0.02	0.01	0.02	0.01	0.01
Beverages	0.01	0.01	0.02	0.01	0.01	0.01	0.01
Processed food	0.03	0.08	0.02	0.03	0.01	0.10	0.04
Other food	0.01	0.01	0.01	0.01	0.01	0.01	0.01
				1998			
Rice	0.74	0.69	0.71	0.66	0.75	0.57	0.70
Cereals	0.05	0.04	0.03	0.05	0.03	0.04	0.02
Roots and tubers	0.02	0.01	0.03	0.03	0.01	0.01	0.01
Pulses and legumes	0.02	0.02	0.02	0.01	0.01	0.02	0.01
Dairy products and eggs	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Meat and offal	0.04	0.04	0.03	0.03	0.03	0.04	0.04
Fish and seafood	0.02	0.03	0.04	0.06	0.03	0.05	0.05
Oils and fats	0.03	0.04	0.04	0.03	0.03	0.04	0.04
Sugar and honey	0.02	0.02	0.02	0.02	0.02	0.03	0.03
Fruits	0.03	0.03	0.03	0.03	0.04	0.05	0.04
Vegetables	0.01	0.02	0.01	0.02	0.01	0.02	0.01
Beverages	0.02	0.02	0.02	0.02	0.03	0.02	0.01
Processed food	0.04	0.09	0.07	0.06	0.02	0.12	0.05
Other food	0.01	0.01	0.01	0.01	0.00	0.01	0.01

Notes: NU=Northern Uplands, RR=Red River Delta, NC=Northern Coastal, SC=Southern Coastal, CH=Central Highlands, HCM=Ho Chi Mihn, MD=Mekong Delta

Source: Author's calculations using VLSS 1993 and 1998.

Table 4
Mean calories per day and Simpson index: by deciles by urban and rural areas and by regions, 1993-98

	Mean calories per day		Simpson index	
Expenditures deciles	1993	1998	1993	1998
10%	1488	1790	0.29	0.38
20%	1716	2024	0.31	0.40
30%	1863	2177	0.33	0.42
40%	1971	2279	0.35	0.46
50%	2060	2331	0.38	0.48
60%	2126	2394	0.40	0.51
70%	2220	2413	0.44	0.55
80%	2274	2484	0.49	0.58
90%	2476	2502	0.54	0.63
100%	2557	2587	0.66	0.72
Rural	2060	2281	0.39	0.47
Urban	2021	2218	0.54	0.63
Northern uplands	2046	2320	0.43	0.47
Red River Delta	2101	2404	0.39	0.52
Northern coastal	1879	2205	0.39	0.50
Southern coastal	1977	2199	0.43	0.53
Central highlands	2080	2145	0.38	0.43
Ho Chi Mihn City	2005	2241	0.49	0.62
Mekong Delta	2173	2209	0.42	0.48
Total	2053	2267	0.42	0.51

Source: Author's calculations using VLSS 1993 and 1998.

Rice has remained the main calorie source for many households but during the interval considered, 1993 and 1998, changes occurred in particular in the top deciles of the expenditure distribution. The share of rice calorie declined dramatically in five years and rich households tended to diversify their diets. At first glance, these results in conjunction with the average calories per day given in Table 4, might suggest low calorie expenditure elasticity. Rich households, instead of increasing their calorie intake, tended to use more expensive micronutrients rich items like fish, meat, vegetables, etc. as replacment for rice (Tables 2 and 4). On the other hand, poor households spent their expenditure on additional food without substantially modifying the composition of their food balance (Tables 2 and 4).

Table 2 reveals a low sensitivity of calorie shares to relative price variations. Although rice prices were higher in comparison to potential substitutes, their share decreased. Moreover, rich households increased their share of calories, acquiring items that had been affected by the biggest increase in relative prices (meat and fish). Milk was the only item in which the variation in consumption shares was linked to price. The decline in relative price was accompanied with an increased calorie share for this item among rich households. These findings are consistent with results on Indonesia (Skoufias 2003).

Changes in relative calorie prices appeared to be partially linked with how households acquired their calories. Despite the increase in the relative price of rice, poor households seemed to spend the additional expenditure received in 1998 on rice as long as it remained the more convenient calorie source and alternatives were less attractive from a nutritional point of view.

On the other hand, rich households tended to diversify their diet, considering relative price variation not so relevant. The reduction in rice share has not been compensated by strong variation in the consumption of now relatively less expensive items, but by an increase in the share of tastier but more expensive items.

4 Calorie consumption distribution and dietary diversity

Next, we focus our attention to the calorie distribution and dietary diversity. The 1998 situation in comparison to 1993 shows important improvements in calorie consumption and calorie distribution. For a comparison of the two years, we calculate the mean distribution of calories by deciles and by urban and rural areas. Low-expenditure households (Table 4) increased their daily calorie consumption and this trend is evident particularly for the poorest households.

The calorie consumption growth rate declined in both survey years, starting from the 3rd decile. Thus we suspect that the expenditure calorie relation is monotonically increasing and logarithmic: this pattern contributed to a convergence in calorie availability during the 1990s. This decelerating rate of growth confirms the change in the composition of commodities evidenced in the previous section. We test this hypothesis using the Simpson index (Table 4), an index of food diversification (Migotto, Carletto and Davis 2005).

What clearly emerges is the fact that diversification was associated more with per capita monetary consumption than calorie consumption. Assuming that food diversity is a good indicator of the 'access dimension of food security'[1] (Hoddinot and Yohannes 2002), our data confirm the existence of an improvement in food security from 1993 to 1998 for all expenditure deciles, in all regions as well as for both urban and rural areas (Table 4).

To check the robustness of these findings and to better understand the evolution of calorie distribution, we compute and compare the cumulative distribution functions of calorie intake (Meenakashi and Vishwanathan 2003) in the seven Vietnamese administrative regions[2] for 1993 and 1998. To show which distribution is stochastically dominant, or in other words, if associated with a higher welfare, one of the curves should lie to the right of the other function (Figure 1).

Based on the results, we can divide the seven regions into two different groups. Five regions exhibit both clear stochastic dominance and evidence of economic improvement. Our data confirm that the increased expenditure per capita was only partially used to increase the per capita calorie intake. The example of north coastal region is straightforward. The strong reduction in the poverty rate (-26 per cent according to GSO) introduced a general improvement in calorie distribution, benefiting mostly poor households. The same can be said for the Red River Delta where poverty plummeted about 36 per cent, and an increase in calorie availability is noted. It is interesting to note that economic improvement determined not only an increase in calorie quantity but also in quality. This is evident particularly in Ho Chi Mihn (HCM) region and the Red River Delta.

Tables 2 and 3, comparing 1993 and 1998, show a strong reduction in the consumption of rice and other micronutrient-poor items and, conversely, an increase in nutrition protective foods—meat, fish, fruits—that are important sources of vitamins, calcium, iron, etc. In the northern uplands, where the general conditions were more disadvantaged (less infrastructure, less productive agriculture, etc.), economic improvement manifested only in an increase in calorie availability, as here food diversification increased less than in other regions.

If the calorie expenditure relationship could be depicted as a succession of stages where the first phase represents a scenario of 'more expenditure equals more calories' and the second phase represents 'more expenditure equals better food quality' (the same food items but of higher quality and infra food groups substitution), then over the period 1993 and 1998, the northern uplands stagnated at the first stage while the north coastal, Red River Delta and HCM were at the second phase (Table 4).

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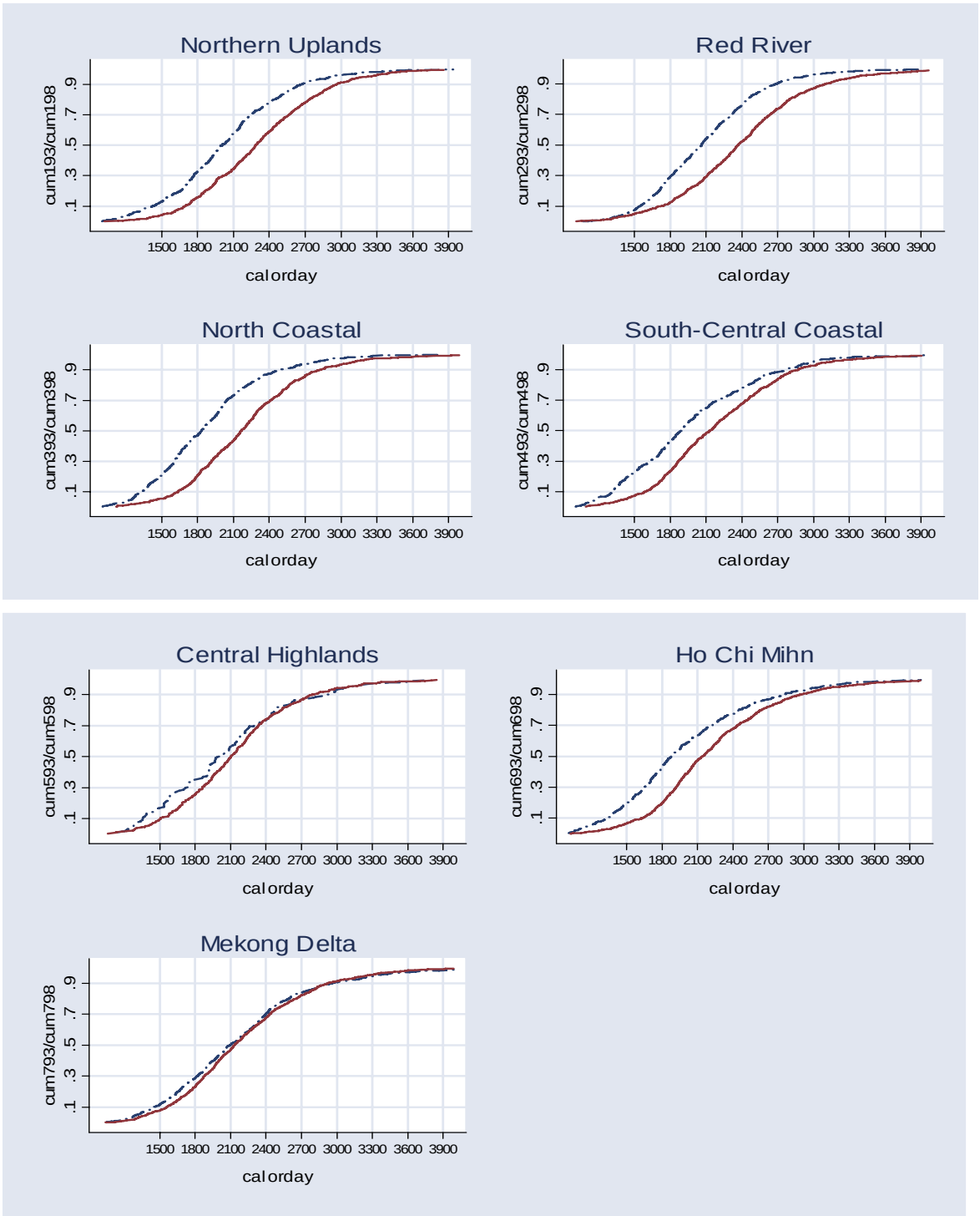
1 A measure of the population's ability to acquire available food during a given period

2 The stratification of the samples in the two periods is different. The 1993 distribution is stratified by rural and urban areas while 1998 distribution is stratified by rural and urban and by regions. The two distributions are not fully comparable by regions as the 1993 survey is not regionally representative. We decide to include these graphs for the reason that they confirmed the previous analysis, indicating that the results were not inconsistent. Official statistics based on VLSS compare various measures at regional level too, specifying the limits of this type of analysis.

The curves for the rest of the regions tend to intersect and might not exhibit first-order stochastic dominance. Nevertheless, we observe unambiguous modifications in the distribution. The left tail shifted in both regions. This implies that the proportion of people consuming low calarie quantities has dropped. The intersection occurs close to the limit of 2100 calories per day, the official Vietnamese calorie norm. In both cases, the number of people consuming less than 2100 calories per day decreased almost 50 per cent, but the interpretation of the two variations is different.

Figure 1
Cumulative distribution functions for calories by regions, 1993 and 1998



Source: Author's calculations using VLSS 1993 and 1998.

The increase in expenditures in the Mekong Delta introduced a greater decline in calories derived from rice and other cereals, but the effect of economic improvement in the central highlands was mostly an addition of consumed calories. Initial conditions, however, were also different. The Mekong Delta is one of the most productive areas of the country and comparatively more urbanized. Therefore, the calorie per day might be a less valid indicator of wellbeing. We analyse this aspect further in the following section but urban households in general have a lower calorie intake as their lives are more sedentary than rural households.

Moreover, richer households tend to have comparatively lower calorie/expenditure elasticity, as they spend more on quality (calorie-poor items like fruit and vegetables) and more in non-food items. Thus, it is not surprising that beyond a certain threshold, the calorie expenditure elasticity becomes zero or even negative, and in some rich households (Deaton 1997), the daily calorie consumption does not differ substantially form middle-expenditure consumption.

In conclusion, we might say that the improvements in calorie distribution have been widespread all over the country and the calorie per day intake suggests a clear trend toward convergence, as the richer householders reduce their intake and the poor ones increase theirs. As calorie availability is one of the commonly used measure to evaluate food security, we can tentatively conclude that food security is improving in almost all of Vietnam.

In the northern regions, the increase in expenditures recorded from 1993 and 1998 translated in an increase in the consumed calories per day and a clearcut improvement in calorie distribution. On the other hand, in two out of the four southern regions, the comparatively richer households (except in the central highlands) spent more to vary their diets rather than increasing the daily calorie intake and, of course, more on non-food instead of food items.

Another important point to stress is that food security, although improved, is not yet fairly distributed and a lot of households are still food insecure or extremely vulnerable. Over the period 1993 to1998, an increasing number of households augmented their daily calorie consumption, but the calorie source remained almost the same for a great share of population.

We observed important changes in the dietary diversity of even the low-consumption deciles, but poor households continued to acquire most of their calorie needs from rice and other cereals. Only a little portion of the population, located in specific areas of the country, have started to diversify their diets. *Ceteris paribus* with the same amount of calories per day consumed, households with more diversified diets are better off, as they are nutritionally better protected and more resistant to illness (Vishwanathan and Meenakshi 2001).

5 The calorie expenditures relation: a multivariate analysis

The analysis so far has not considered other important effects that may influence calorie consumption. It is important to check the robustness of the results of the previous section by controlling for the age of household members, household composition,

location, prices and other observable characteristics. We run two different OLS regressions for 1993 and 1998, using White correction for robust standard errors (to correct for potential heteroscedasticity). Regarding the potential endogeneity problem caused by the unclear causality relation between nutrition and income (Stiglitz 1975), we use the argument proposed by Subramanian and Deaton (1996). In the case of Vietnam, it was possible in both years to buy 2000 calories (rice) for less than 2000 *dong*. The average rural worker can easily buy this quantity, spending 5 per cent of his daily wage (GSO 2000). This calorie quantity provides the farmer with sufficient energy for a full day's activity. We find no evidence of a nutrition trap. Per capita expenditures are significant and have a positive effect on calories (Table 5). As expected, the elasticity drops from 1993 to 1998; elasticity in 1993 is slightly below 0.36, but drops in few years to 0.25. This result is consistent with the important economic improvements recorded in Vietnam during the period considered.

Most of the other variables have well observed effects on calorie consumption. Bigger families, presumably those with more children, tend to consume comparatively less calories per day while older households consume comparatively more calories than particularly young ones or the very old ones (the tails of the age cohorts). Rural household need, on average, more calories and, as a consequence, the urban dummy is negative and significant.

The prices of the most commonly consumed items have, in all cases, a negative and significant impact. In particular, the rice price elasticity (the main item consumed by almost all households) shows the greatest value in all three regressions. Not surprisingly, the household appears to be extremely sensitive to the price variations of 'other cereals', confirming our analysis on the balance of shares of food: cereals still provide about 70 per cent of the calories of a household.

Table 5
Regression results for rural and urban areas, 1993 and 1998

	1993	1998
Log of outlay	0.359**	0.246**
Urban (1:urban; 0:rural)	-0.143**	-0.072*
Age group from 30	0.013	0.021*
Age group from 40	0.071**	0.065**
Age group from 50	0.107**	0.085**
Age group from 60	0.084**	0.078**
Spring dummy	0.015	0.017*
Summer dummy	0.031**	-0.007
Household size	-0.016**	-0.028**
Gender of HH.head (1:M; 0:F)	0.027**	0.027**
Cereals price (log)	-0.010**	-0.025**
Fish price (log)	-0.009*	-0.009
Rice price (log)	-0.095**	-0.109**
Oils and fats price (log)	0.009*	-0.017**
Constant	4.763**	5.552**
Observations	4530	5846
Robust R-square	0.52	0.43

6 Conclusions

In the present contribution we have investigated the changes in wellbeing that have occurred in Vietnam during the 1990s, analysing for the first time the evolution of food security for this country. Our aim was to check the robustness of Vietnam's impressive economic improvements by proposing food-security measures and searching for an association of certain degree between the typical monetary approach results and ours.

Descriptive statistics are useful for understanding the pattern of change. In Vietnam, between 1993 and 1998 the average caloric intake, the most common measure of food security, increased in almost all regions of the country, albeit with a diverging intensity. Poor households generally living in rural areas increased their calorie consumption while the richer households reduced the quantity of consumed calories, preferring an improvement in quality. The decline in rice and cereals consumption has been substantial, particularly among the richest strata of the population, and more in southern Vietnam than in the north. We were able to examine the food balance changes and found evidence of micronutrients-poor items (rice and cereals) being substituted with nutrient-rich items like fruit, vegetables, fish and meat. The diets of poor household, although increasing in the amount of calories consumed, still lacked vitamins, iron, calcium, etc. A preliminary assessment of the food security variation showed that improvements were, as expected, more concentrated among the richer households rather than the poor. Furthermore, dietary diversity indicators showed little improvement among the poorer strata.

We also focused on the calorie/expenditure elasticity and compared elasticities for the years 1993 and 1998. Households in Vietnam were found to be more food secure when their status was measured according to calorie intake and dietary diversity indicators, and exhibited a statistically significant reduction in calorie income elasticity. We conclude that in general food security has improved in Vietnam during the 1990s, although substantial differences still exist among expenditure deciles and among regions due to the accentuated spatial difference.

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