Effects of Market Work and Own Household Work on Nutrition Intake of Rural Adults: The Case of Vietnam

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1. Introduction

In the 1990s, Vietnam experienced rapid market development, but rural people could not gain enough nutrition intake. We estimate effects of this development on nutrition intake of rural adults by focusing on increased market work and decreased own household work, the latter of which includes self-employed farm and non-farm work, and household work.

The *doi moi* reforms in the late 1980s spurred market development in Vietnam. Pham and Reily (2007) found that real wage rate grew by over 10% per annum and participation rate in market work rose from 22% (13%) to 34% (21%) for males (females) in the 1990s. Edmonds and Pavcnik (2006) found that the real price of rice rose by 30% between 1993 and 1998 after liberalization of rice trade. Under such market development, the prevalence of underweight (share of adults with Body Mass Index (BMI) lower than 18.5) reduced from 31% to 20% for urban adults but from 33% to 27% for rural adults in the same period (Tuan, Tuong, and Popkin, 2008).

Why did nutrition intake of rural adults improve slowly under rapid market development? After observing *higher* calorie consumption of rural adults due to more consumption of rice, Thang and Popkin (2004) attribute the reason to more engagement in such strenuous work as farm work, although they did not verify this hypothesis.

Ngyuen et al. (2007) use Vietnam Living Standards Survey (VLSS) for 1992/93 and 1997/98 (1992 and 1997 hereafter) and apply the decomposition method of Machado and Mata (2005) to investigate reasons for expanded difference in real per capita consumption between urban and rural households. They found that most of the expanded difference is explained by increased returns to individual and household characteristics (e.g, education), an important consequence of market development. O'Donnell et al. (2009) used the same data and method to find that consumption growth in the 1990s improved children's nutrition intake even after controlling for other factors that may explain nutrition intake. These results suggest that nutrition intake of rural adults improved slowly because the market development raised incomes of rural adults more slowly through lower returns to their characteristics.

To answer our question addressed above, we use VLSS for the years 1992 and 1997, in which rapid market development were reported in Vietnam. Using BMI as a measure of nutrition intake, we compare BMI between urban and rural adults (individuals aged 18-65 years) and find relevant factors to explain urban-rural BMI difference by paying attention to the role of market development. To find a better explanation of this difference in our context, Edmonds and Pavcnik (2006) provides a good perspective.

They use VLSS to find that the liberalization of rice trade in the 1990s had a positive effect on market work but a negative effect on own household work because it favored non-farm firms in developed areas more than self-employed producers in rural areas. Their findings suggest that market development can be interpreted as a changing process of decreasing own household work and increasing market work.

This interpretation induces us to use a "nutrition production function (NPF)" of Higgins and Alderman (1997) for evaluating the effect of market development on nutrition intake. We specify an NPF with BMI as a dependent variable, and market and own household work of the individual, per capita calorie consumption within his/her household, and individual and household characteristics as explanatory variables. The NPF can identify two distinct effects of market development on nutrition intake of adults. One is a direct effect of less (more) engagement in physically more (less) demanding work, i.e., "less energy expenditure effect". The other is an indirect effect of increasing wage incomes and purchasing more meat and eggs (more consumption of protein and lipids), i.e., "more balanced nutrients effect".

As a first step to studying effects of market development on nutrition intake, we use the method of instrumental variables to estimate NPFs separately for urban and rural adults in 1992 and 1997 and examine how coefficients of these functions differ between them. Next section explains data source and examines basic statistics, especially the difference in BMI, calorie consumption, work hours between rural and urban adults. The third section explains our empirical model and estimation method. The final section summarizes estimation results.

2. Data

Our empirical analysis uses data from the Vietnam Living Standards Survey (VLSS) for 1992 and 1997. The original data cover 24068 individuals in 4800 households for 1992 and 28633 individuals in 5999 households for 1997. After dropping observations with missing data for relevant variables, our data sets for 1992 and 1997 respectively include 5613 and 7501 adult males (18 years or older) and include 6491 and 8645 adult females (18 years or older, and not pregnant).

Tables 1.1 and 1.2 present basic statistics for relevant variables for adult males and females, respectively. Data of most variables come directly from data of original variables in the VLSS (including information on rural and urban communes) and surveyed for 1992 and 1997 in the same way. In particular, market work hours (per week) are defined as work hours for which wages (in cash and in kind) are paid.

"Housework" are defined as the sum of hours devoted to cleaning and cooking and those devoted to non-agricultural self-employed work for simplicity. On the other hand, some variables have different definition between 1992 and 1997 due to changes of the questionnaires. In particular, we define farm work hours for 1992 as hours worked in self-employed agricultural sector, whereas we define those for 1997 as the sum of hours worked in six self-employed activities (crop and fruit production, livestock raising, production of aquatic products, forestry, processing of home-produced agricultural products, transport, marketing, and sales of agricultural products).[1] Finally, the VLSS for both 1992 and 1997 provides data on quantity consumed for 45 food items, which are converted into calorie consumption using the conversion factor table of Mishra and Ray (2006).

Now, we compare BMI, work hours, and calorie consumption between rural and urban males in Table 1.1. Average BMI's for 1992 and 1997 are 19.2 and 19.6 for rural males, and they are 19.6 and 20.4 for urban males, showing that BMI is 2% (4%) higher for urban males in 1992 (1997) and that it increased for both rural and urban males during the rapid market development. Furthermore, the distribution of BMI was wider in 1997 for both rural and urban males, as shown by larger standard deviations of BMI for this year.

Turning to work hours, market work hours for rural and urban males increased from 7.0 and 16.9 in 1992 to 7.4 and 18.3 in 1997, respectively, indicating that market work hours increased for both types of males and that the hours for urban males are 2.5 times as long as those for rural males in both the years. Slightly faster increase for urban males is attributed to their higher participation rate in market work in 1997. Actually, the participation rate for rural and urban males increased from 19% and 36% in 1992 to 20% and 38% in 1997. Conditional on the participation, market work hours did not change so much between the two years: rural and urban males worked for about 37 and 48 hours per week in these years.

On the other hand, farm work hours exhibited different patterns. Rural males increased farm work hours from 22.6 to 25.1, whereas urban males decreased them from 4.2 to 2.8. The former may reflect a rapid rise in rice price during 1990s, as evidenced by Edmonds and Pavcnik (2006), whereas the latter may reflect higher incentives of urban males to reallocate their time from farm to non-farm work to benefit from faster market development in urban regions.

Furthermore, "housework" hours are much longer for urban males, reflecting their longer work hours in non-agricultural self-employed work. Unlike other activities, these hours decreased (from 14.2 to 11.6 or from 22.8 to 20.9) during market development for both rural and urban males.

Next, we compare BMI, work hours, and calorie consumption between rural and urban females in Table 1.2. Average BMI's for 1992 and 1997 are 19.4 and 19.6 for rural females, and they are 20.1 and 20.8 for urban females, showing that showing that BMI is 4% (6%) higher for urban females in 1992 (1997) and that it increased for both rural and urban females during the rapid market development. Similarly to the case of males, BMI had a wider distribution for both rural and urban females in 1997.

Market work hours for females are roughly half as long as those for males. These hours for rural and urban females changed from 3.1 and 11.6 in 1992 to 3.4 and 11.3 in 1997, respectively, suggesting that females may not be benefitted from market development sufficiently. Participation rate in market work stayed around 9% and 25% for rural and urban females in the two years, and rural and urban females worked roughly 36 and 46 hours per week in these years, conditional on the participation.

Farm work hours for females are found to be very similar to those for males. These hours are more than 20 hours and increased from 1992 to 1997 for rural females, whereas they are shorter than 5 hours and decreased during market development for urban females. On the other hand, "housework" hours for females are 50% (or 60%) longer than those for males in both the years, reflecting their longer work hours in cooking and cleaning. Similarly to males, these hours decreased during the market development for both rural and urban females

Finally, calorie consumption within the household (per capita per day, unit: kcal) is much higher for rural males (or females) in both the years partly because they consume more rice, as shown by other studies (e.g., Thang and Popkin, 2004).[2)] Furthermore, calorie consumption increased by 1.8% for rural males between the two years, whereas it decreased by 1.1% for urban males. Therefore, the difference in calorie consumption between rural and urban males (females) increased during the period of market development.

3. Empirical Method

Higgins and Alderman (1997) extend a household production function of Rosenzweig and Schultz (1983) to specify a nutrition production function (NPF).[3)] We follow them to use BMI as a dependent variable and write our NPF for individual i in group g (R: rural, U: urban) as

$$BMI_i^g = \alpha^g + \boldsymbol{X}_i^g \boldsymbol{\beta}^g, \tag{1}$$

where $\boldsymbol{X}_i^g$ denotes a vector of explanatory variables and $\boldsymbol{\beta}^g$ denotes the corresponding coefficient vector. Vector $\boldsymbol{X}_i^g$ in our analysis include four subvectors. The first is a vector $\boldsymbol{Z}$ of current nutrition-related inputs,[4] which include calorie consumption per capita per day (kcal)[5], sick days in the past four weeks, health care expenditures within the household (thousand dong per year),[6] and hours of market work and own household work (sum of farm and "housework" hours). The second is a vector $\boldsymbol{I}$ of individual characteristics, which include age, age squared, height, and dummy variables for diploma of primary school, lower secondary school, and upper secondary school or higher education. The third is a vector $\boldsymbol{S}$ of household characteristics, which include household size, and the last is a vector $\boldsymbol{E}$ of factors contributing to the current local health environment, which include regional dummy variables for Northern Uplands, Red River Delta, North Central, Central Coast, Central Highlands, and Southeast.[7]

We estimate the NPF (1) using the method of instrumental variables (IVs). Our preliminary analysis assumes four endogenous variables: market work, own household work (including farm work and "housework"), calorie consumption, and health expenditures and uses only commune level prices (rice, pork, five kinds of medicine, and a fertilizer) as instruments for them. We choose instruments for each type of individuals (rural males, urban males, rural females, and urban females) for each year (1992 and 1997) to satisfy their joint significance in the first stage regressions and their orthogonality to the error term, although some IV sets seem weak due to limited availability of IVs in this preliminary analysis (see Tables 2.1 and 2.2).

4. Results

Estimated coefficients $\boldsymbol{\beta}^g$ in the NPF (1) are presented separately in Table 2.1 for males and Table 2.2 for females, where t-values are shown in parentheses and p-values are shown in brackets. OIR represents a statistic for the overidentifying restrictions test and F(X) represents an F statistic to test joint significance of IVs in the first stage regression of endogenous variable X.

We first examine estimation results for adult males in Table 2.1. Calorie consumption and health expenditures have positive effects on BMI when they are estimated statistically significant, and sick days have a negative effect on BMI for all cases. Furthermore, age has an inverted U effect on BMI: this effect rises until age reaches near 35 (between 40 and 50) for rural (urban) males and falls after this age.

Turning to the effect of work hours on BMI, it is insignificant or negative. Due to greater energy expenditure effects, own household work has a negative effect on BMI for rural males, who devote much longer hours to farm work which seems to require physically harder work. This effect was statistically significant in 1992, but it disappeared in 1997 possibly reflecting better work environment in agricultural production after the beginning of market development. On the other hand, market work has a statistically negative effect on BMI for urban males in 1992, which seemingly contradicts with more balanced nutrients effect from more market work. This result suggest that wages paid for urban males in 1992 were not high enough to purchase more meat or eggs to gain balanced nutrients or that they undertook physically hard work in urban regions, although this negative effect disappeared in 1997.

Now, we examine estimation results for adult females in Table 2.2. Similarly to the results for adult males, calorie consumption and health expenditures have positive effects on BMI when they are estimated statistically significant, and sick days have a negative effect on BMI for all cases. However, unlike the results for adult males, age does not have a clear effect on BMI.

Effects of work hours on BMI for adult females show different patterns from those for adult males. For rural females, own household work had no effect on BMI in 1992, and it had a weak negative effect in 1997. The former might be because rural females spent similar hours to farm work (more physically demanding work) and "housework" (combination of cooking and cleaning with non-agricultural self-employed work). The weak negative appeared in 1997 partly because their farm work increased to cover decrease in their "housework" during the market development. For urban females, own household work had a positive effect on BMI in 1992 reflecting their much shorter hours of farm work, although the positive effect disappeared in 1997. On the other hand, market work had a negative effect on BMI for rural females in 1992, and this effect disappeared in 1997, which is similar to the effect of market work for urban males.

Finally, for urban females, market work had a positive effect on BMI in 1992 and this effect disappeared in 1997. The positive effect is consistent with more balanced nutrients effect from more market work, although we cannot find similar effects for other types of individuals or in the different year.

Footnotes

1) Although the VLSS in 1997 has detailed questionnaire for work hours in self-employed agricultural production, most individuals report no work hours for the other five activities than crop and fruit production.
2) Calorie consumption per capita per day is estimated to be lower than other studies because categories for "others" are not adjusted appropriately (see e.g., Molini, 2006)

in this preliminary analysis. For this reason, we do not examine proportion of individuals with undernourishment but examine only effects of work hours and calorie consumption on BMI.

3) Other studies estimating similar production functions include Barrera (1990) and Cebu Study Team (1992).

4) Parity (fertility history) for females is not included because the VLSS for 1992 and 1997 provides this information only for randomly drawn females.

5) Because we use per capita calorie consumption within the household, we follow Higgins and Alderman (1997) to include household age-sex composition variables in our regression.

6) One thousand Vietnam dong approximately equals 0.045 US dollar.

7) Mekong River Delta is used as a base group.

References

Barrera, A. (1990) "The Role of Maternal Schooling and Its Interaction with Public Health Programs in Child Health Production" *Journal of Development Economics* 32, pp. 69-91.

Cebu Study Team (1992) "A Child Health Production Function Estimated from Longitudinal Data" *Journal of Development Economics* 38, pp. 323-352.

Edmonds, E. V. and N. Pavcnik (2006) "Trade Liberalization and the Allocation of Labor between Households and Markets in a Poor Country" *Journal of International Economics* 69, pp. 272-295.

Higgins, P. A. and H. Alderman (1997) "Labor and Women's Nutrition: The Impact of Work Effort and Fertility on Nutritional Status in Ghana" *Journal of Human Resources* 32, pp. 577-594.

Machado, J. A. F. and J. Mata (2005) "Counterfactual Decomposition of Changes in Wage Distributions Using Quantile Regression" *Journal of Applied Econometrics* 20, pp. 445-465.

Mishra, V. and R. Ray (2006) "Dietary Pattern, Calorie Intake and Undernourishment: The Vietnamese Experience" Discussion Paper 2006-02. School of Economics and Finance, University of Tasmania.

Molini, V. (2006) "Food Security in Vietnam during the 1990s: the Empirical Evidence" UNU-WIDER Research Paper No. 2006/67, Helsinki.

Ngyuen, B. T., J. W. Albrecht, S. B. Vroman, and M. D. Westbrook (2007) "A Quantile Regression Decomposition of Urban-Rural Inequality in Vietnam" *Journal of*

Development Economics 83, pp. 466-490.

O'Donnell, O., Á. López Nicholás, and E. van Doorslaer (2009) "Growing Richer and Taller: Explaining Change in the Distribution of Child Nutritional Status during Vietnam's Economic Boom" *Journal of Development Economics* 88, pp. 45-58.

Pham, T. H. and B. Reilly (2007) "The Gender Pay Gap in Vietnam, 1993-2002: A Quantile Regression Approach" *Journal of Asian Economics* 18, pp. 775-808.

Rosenzweig, M. and T. P. Schultz (1983) "Estimating a Household Production Function: Heterogeneity, the Demand for Health Inputs, and Their Effects on Birthweight" *Journal of Political Economy* 92, pp. 723-746.

Thang, N. M. and B. M. Popkin (2004) "Patterns of Food Consumption in Vietnam: Effects on Socioeconomic Groups during an Era of Economic Growth" *European Journal of Clinical Nutrition* 58, pp. 145-153.

Tuan, N. T., P. D. Tuong, and B. M. Popkin (2008) "Body Mass Index (BMI) Dynamics in Vietnam" *European Journal of Clinical Nutrition* 62, pp. 78-86.

Table 1.1. Basic Statistics (Adult Males)

	Rural				Urban			
	1992		1997		1992		1997	
Number of obs.	4346		5217		1267		2284	
BMI	19.21	(1.770)	19.58	(1.922)	19.63	(2.419)	20.42	(2.808)
age	38.84	(16.13)	39.69	(16.34)	38.76	(15.84)	40.56	(16.13)
height	160.7	(6.034)	161.1	(6.062)	162.1	(6.098)	162.1	(6.066)
educ1	0.286	(0.452)	0.280	(0.449)	0.242	(0.428)	0.237	(0.426)
educ2	0.260	(0.439)	0.250	(0.433)	0.245	(0.430)	0.255	(0.436)
educ3	0.233	(0.423)	0.094	(0.292)	0.389	(0.488)	0.296	(0.457)
household size	5.619	(2.369)	5.458	(1.972)	6.025	(2.824)	5.217	(2.183)
males_0_5	0.396	(0.662)	0.276	(0.524)	0.325	(0.583)	0.196	(0.448)
males_6_10	0.361	(0.608)	0.300	(0.552)	0.239	(0.467)	0.189	(0.437)
males_11_20	0.716	(0.908)	0.769	(0.911)	0.690	(0.929)	0.547	(0.799)
males_21_64	1.261	(0.711)	1.323	(0.738)	1.676	(1.019)	1.556	(0.952)
males_65over	0.164	(0.370)	0.184	(0.388)	0.178	(0.393)	0.205	(0.406)
females_0_5	0.381	(0.633)	0.255	(0.517)	0.305	(0.587)	0.194	(0.453)
females_6_10	0.324	(0.585)	0.293	(0.545)	0.241	(0.485)	0.168	(0.424)
females_11_20	0.677	(0.886)	0.667	(0.865)	0.602	(0.833)	0.498	(0.754)
females_21_64	1.227	(0.675)	1.231	(0.661)	1.667	(1.130)	1.481	(0.918)
females_65over	0.154	(0.366)	0.177	(0.387)	0.174	(0.385)	0.209	(0.410)
Northern Uplands	0.168	(0.373)	0.169	(0.375)	0.107	(0.310)	0.089	(0.285)
Red River Delta	0.240	(0.427)	0.158	(0.364)	0.175	(0.380)	0.216	(0.412)
North Central	0.139	(0.346)	0.123	(0.328)	0.058	(0.233)	0.063	(0.244)
Central Coast	0.104	(0.306)	0.116	(0.320)	0.165	(0.371)	0.162	(0.368)
Central Highlands	0.036	(0.185)	0.093	(0.290)	0.000	(0.000)	0.000	(0.000)
Southeast	0.094	(0.291)	0.135	(0.341)	0.306	(0.461)	0.317	(0.465)
Mekong River Delta	0.220	(0.414)	0.207	(0.405)	0.189	(0.391)	0.153	(0.360)
Calorie per capita (kcal/day)	2016.5	(627.2)	2053.8	(512.3)	1760.2	(616.3)	1741.3	(543.0)
sick days (past 4 weeks)	2.509	(5.634)	3.393	(6.177)	2.447	(5.785)	2.695	(5.776)
health expenditure (1000 dong/year)	450.2	(727.1)	749.9	(1399.6)	621.7	(874.7)	1112.8	(2996.4)
market work hours per week	6.980	(16.48)	7.406	(17.21)	16.92	(24.61)	18.26	(25.54)
housework hours per week	14.18	(16.63)	11.57	(16.77)	22.81	(26.28)	20.93	(27.76)
farm work hours per week	22.56	(21.91)	25.09	(20.06)	4.169	(12.24)	2.836	(10.84)

Note: Variables educ1, educ2, and educ3 indicate whether individuals have diploma of primary, lower secondary, and upper secondary school. Household composition variable males_x_y (females_x_y) indicates the number of males (females) in the household aged from x to y. Standard deviations are shown in parentheses.

Table 1.2. Basic Statistics (Adult Females)

	Rural				Urban			
	1992		1997		1992		1997	
Number of obs.	4965		5922		1526		2723	
BMI	19.40	(2.313)	19.62	(2.493)	20.12	(2.908)	20.79	(3.243)
age	40.13	(16.64)	41.48	(16.80)	39.45	(16.18)	41.64	(16.86)
height	150.4	(5.707)	150.8	(5.546)	151.8	(5.906)	151.8	(5.548)
educ1	0.222	(0.415)	0.217	(0.412)	0.224	(0.417)	0.220	(0.415)
educ2	0.207	(0.405)	0.193	(0.394)	0.214	(0.410)	0.219	(0.413)
educ3	0.299	(0.458)	0.056	(0.230)	0.364	(0.481)	0.211	(0.408)
household size	5.492	(2.442)	5.296	(2.049)	5.942	(2.911)	5.135	(2.264)
males_0_5	0.383	(0.649)	0.285	(0.527)	0.335	(0.594)	0.208	(0.463)
males_6_10	0.351	(0.598)	0.296	(0.545)	0.241	(0.463)	0.183	(0.432)
males_11_20	0.628	(0.860)	0.650	(0.847)	0.585	(0.867)	0.476	(0.750)
males_21_64	1.071	(0.710)	1.094	(0.692)	1.384	(1.020)	1.272	(0.889)
males_65over	0.133	(0.340)	0.147	(0.354)	0.159	(0.376)	0.168	(0.375)
females_0_5	0.378	(0.629)	0.269	(0.528)	0.311	(0.595)	0.197	(0.470)
females_6_10	0.311	(0.575)	0.284	(0.535)	0.233	(0.483)	0.174	(0.433)
females_11_20	0.711	(0.917)	0.698	(0.896)	0.685	(0.888)	0.564	(0.808)
females_21_64	1.360	(0.759)	1.341	(0.746)	1.852	(1.202)	1.647	(1.020)
females_65over	0.215	(0.418)	0.247	(0.442)	0.226	(0.429)	0.270	(0.453)
Northern Uplands	0.157	(0.364)	0.155	(0.362)	0.117	(0.322)	0.090	(0.286)
Red river Delta	0.246	(0.431)	0.165	(0.371)	0.170	(0.376)	0.214	(0.410)
North Central	0.146	(0.353)	0.133	(0.339)	0.052	(0.223)	0.067	(0.250)
Central Coast	0.106	(0.308)	0.121	(0.326)	0.166	(0.372)	0.143	(0.350)
Central Highlands	0.035	(0.183)	0.087	(0.282)	0.000	(0.000)	0.000	(0.000)
Southeast	0.084	(0.278)	0.123	(0.329)	0.300	(0.458)	0.328	(0.470)
Mekong River Delta	0.226	(0.418)	0.215	(0.411)	0.194	(0.396)	0.158	(0.365)
Calorie per capita (kcal/day)	1984.0	(621.0)	2014.1	(495.8)	1755.6	(593.4)	1725.4	(539.3)
sick days (past 4 weeks)	3.145	(6.394)	3.973	(6.205)	2.779	(5.738)	3.222	(5.868)
health expenditure (1000 dong/year)	452.8	(723.8)	761.7	(1515.2)	630.2	(878.2)	1199.8	(3431.7)
market work hours per week	3.117	(11.24)	3.443	(12.13)	11.62	(21.89)	11.29	(21.47)
housework hours per week	21.53	(18.51)	18.65	(17.84)	35.94	(28.95)	31.94	(28.11)
farm work hours per week	21.77	(21.52)	22.62	(19.71)	4.388	(11.76)	2.633	(10.29)

Note: Variables educ1, educ2, and educ3 indicate whether individuals have diploma of primary, lower secondary, and upper secondary school. Household composition variable males_x_y (females_x_y) indicates the number of males (females) in the household aged from x to y. Standard deviations are shown in parentheses.

Table 2.1. Estimated Coefficients of Nutrition Production Function (Adult Males)

	Rural				Urban			
	1992		1997		1992		1997	
Number of obs.	4346		5217		1267		2284	
market work	-0.002	(0.09)	-0.041	(1.03)	-0.118	(2.02)	0.005	(0.19)
own household work	-0.039	(1.94)	-0.033	(1.24)	-0.045	(1.39)	-0.007	(0.16)
ln(calorie consumption)	1.967	(2.01)	-0.854	(0.24)	-2.616	(1.48)	0.768	(0.42)
health expenditures	-0.001	(0.98)	0.001	(2.09)	0.000	(0.25)	0.000	(0.43)
age	0.103	(4.21)	0.118	(2.50)	0.314	(2.84)	0.177	(2.20)
age^2	-0.001	(4.58)	-0.002	(2.56)	-0.004	(2.71)	-0.002	(1.91)
height	-0.013	(2.08)	-0.004	(0.34)	0.000	(0.02)	0.011	(0.84)
educ1	0.024	(0.25)	-0.071	(0.58)	0.193	(0.53)	0.351	(0.92)
educ2	0.045	(0.43)	0.152	(0.94)	0.284	(0.75)	0.277	(0.75)
educ3	0.077	(0.60)	0.374	(1.78)	0.355	(0.98)	0.924	(2.46)
household size	0.075	(0.41)	-0.433	(1.92)	-0.288	(0.76)	-0.746	(2.55)
males_0_5	0.292	(2.02)	0.327	(1.30)	-0.392	(0.89)	0.745	(1.71)
males_6_10	0.115	(0.70)	0.297	(2.08)	-0.180	(0.44)	0.795	(2.16)
males_11_20	-0.032	(0.18)	0.374	(1.76)	0.280	(0.74)	0.750	(2.45)
males_21_64	-0.135	(0.80)	0.291	(1.30)	0.125	(0.32)	0.674	(2.27)
males_65over	0.036	(0.20)	-0.169	(0.64)	-0.015	(0.03)	0.953	(2.54)
females_0_5	0.170	(1.20)	0.349	(1.07)	0.124	(0.28)	0.830	(1.84)
females_6_10	0.123	(0.78)	0.318	(2.11)	0.214	(0.47)	0.715	(1.98)
females_11_20	-0.042	(0.26)	0.298	(1.97)	0.183	(0.48)	0.815	(2.63)
females_21_64	-0.044	(0.31)	0.237	(1.65)	0.290	(0.68)	0.925	(3.08)
females_65over	0.090	(0.56)	0.176	(1.12)	0.709	(1.20)	0.661	(1.39)
sick days	-0.038	(2.83)	-0.072	(2.62)	-0.100	(2.82)	-0.016	(0.51)
OIR	5.987	[0.11]	0.407	[0.52]	1.765	[0.62]	0.110	[0.74]
F (market work)	4.558	[0.00]	3.888	[0.00]	2.839	[0.01]	3.168	[0.01]
F (own household work)	3.809	[0.00]	9.314	[0.00]	7.445	[0.00]	2.995	[0.01]
F (calorie consumption)	11.339	[0.00]	3.032	[0.01]	8.980	[0.00]	17.279	[0.00]
F (health expenditure)	8.157	[0.00]	3.423	[0.00]	6.430	[0.00]	1.10	[0.36]

Note: OIR represents a statistic for overidentifying restrictions test and F(X) represents an F statistic to test joint significance of instrumental variables in the first stage regression of an endogenous variable X. t-values are shown in parentheses and p-values are shown in brackets.

Table 2.2. Estimated Coefficients of Nutrition Production Function (Adult Females)

	Rural				Urban			
	1992		1997		1992		1997	
Number of obs.	4965		5922		1526		2723	
market work	-0.108	(1.81)	0.056	(0.88)	0.091	(1.89)	-0.193	(0.93)
own household work	0.011	(0.48)	-0.042	(1.15)	0.053	(2.05)	-0.106	(0.60)
ln(calorie consumption)	-1.665	(1.30)	11.881	(1.99)	3.100	(1.24)	-2.242	(0.57)
health expenditures	-0.001	(0.61)	0.002	(1.78)	0.002	(2.43)	0.002	(1.24)
age	0.013	(0.30)	0.181	(2.72)	0.111	(1.60)	0.534	(1.31)
age^2	-0.001	(0.99)	-0.002	(2.60)	-0.001	(0.83)	-0.006	(1.21)
height	0.002	(0.22)	-0.021	(1.28)	-0.010	(0.50)	-0.008	(0.23)
educ1	-0.136	(0.91)	0.035	(0.15)	-0.354	(1.09)	1.211	(1.03)
educ2	-0.109	(0.89)	-0.049	(0.19)	-0.442	(1.27)	1.111	(0.69)
educ3	0.255	(1.38)	-0.447	(0.71)	-0.645	(1.48)	1.769	(0.90)
household size	-0.241	(1.39)	0.455	(1.36)	-0.044	(0.13)	-1.478	(1.35)
males_0_5	0.033	(0.19)	0.438	(1.08)	-0.018	(0.03)	0.774	(0.74)
males_6_10	0.193	(1.16)	-0.044	(0.17)	0.227	(0.47)	0.789	(1.00)
males_11_20	0.347	(2.00)	-0.565	(1.58)	0.173	(0.49)	1.957	(1.32)
males_21_64	0.242	(1.16)	-0.596	(1.58)	0.078	(0.22)	1.164	(1.40)
males_65over	0.222	(0.72)	-1.038	(2.04)	0.161	(0.33)	-0.124	(0.17)
females_0_5	0.091	(0.52)	0.848	(1.64)	-0.020	(0.04)	1.129	(0.88)
females_6_10	0.048	(0.27)	0.094	(0.35)	0.361	(0.77)	1.370	(1.05)
females_11_20	0.320	(2.07)	-0.160	(0.63)	0.166	(0.46)	1.273	(1.35)
females_21_64	0.407	(2.40)	-0.671	(2.07)	-0.038	(0.10)	0.715	(0.88)
females_65over	0.459	(2.27)	-0.315	(1.03)	-0.052	(0.11)	-0.574	(0.62)
sick days	-0.016	(0.81)	-0.082	(2.08)	-0.053	(2.00)	-0.201	(1.02)
OIR	1.346	[0.51]	0.553	[0.76]	3.197	[0.20]	0.170	[0.68]
F (market work)	5.422	[0.00]	6.067	[0.00]	4.220	[0.00]	2.949	[0.01]
F (own household work)	5.176	[0.00]	8.121	[0.00]	5.782	[0.00]	1.097	[0.36]
F (calorie consumption)	10.658	[0.00]	2.935	[0.01]	9.321	[0.00]	9.769	[0.00]
F (health expenditure)	7.432	[0.00]	4.390	[0.00]	8.104	[0.00]	1.914	[0.089

Note: OIR represents a statistic for overidentifying restrictions test and F(X) represents an F statistic to test joint significance of instrumental variables in the first stage regression of an endogenous variable X. t-values are shown in parentheses and p-values are shown in brackets.