YOUNG LIVES STUDENT PAPER

Private and Public Determinants of Early Child Health in Vietnam

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The data used in this paper comes from Young Lives, a longitudinal study investigating the changing nature of childhood poverty in Ethiopia, India (Andhra Pradesh), Peru and Vietnam over 15 years. For further details, visit: www.younglives.org.uk.

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Young Lives
An International Study of Childhood Poverty

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INTRODUCTION

This chapter starts with the problem statement in section 1.1. The remaining section presents research objectives, research question, research scope, and research methodology in section 1.2, 1.3, 1.4 and 1.5 respectively. And then, the thesis structure is presented in the final section of this chapter, section 1.6.

1.1. Problem Statement

Malnutrition at the early stages of life can lower child resistance to infections, increase child morbidity and mortality, and decrease mental development and cognitive achievement. The children will subsequently do poorly in school that lead to lower labor productivity when becoming adults, and are more likely to transfer poverty to the next generation. Therefore, World Bank classified poor nutrition of children as one of causes leading to "perpetuate poverty" (World Bank, 2006). In Vietnam, one fourth of the children are still malnutrition in 2005 (UNICEF, 2006). Families in the northern regions, rural households, and ethnic families have greater levels of malnutrition than the rest population (Haughton and Haughton, 1997). In addition, the awareness in developing countries and in international development-oriented organization on accessing impacts of health programs on early child health that has increased in recent years (World Bank, 2007). The first UN Millennium Development Goal is to eradicate extreme poverty and hunger, and the second is to ensure that all children complete primary schooling. Improving early child development is clearly an important step to reaching these goals. More recognition about the effect of poverty and malnutrition on children's development is critical for policymakers to conduct early intervention. Despite the interest, as the same circumstance in other developing countries, impacts of such programs on child health has still not yet been researched in Vietnam except the work of Glewwe et al. (2002). Glewwe et al. (2002) is to examine impact of various health programs on child nutrition. Glewwe et al. (2002) suggest providing commune health centers with good facilities (e.g. sanitary toilets, and more than enough supplies of oral rehydration salts) could have positive impact at raising child (as well as adult)

health. However, that study didn't focus on investigating impacts of health programs on early child health. As other low-income countries, under-nutrient in children under five is a key issue in Vietnam (WHO, 2007). In addition, child development in the first 5 year of life is very important because vital development occurs in all domains (Grantham-Mc Gregor et al., 2007). Therefore, this research will apply multivariate regression model with data mainly from Young Lives Survey for identifying significant determinants of early child health. Specifically, this research is expected to investigate impacts of health programs on early child health which are useful for planning an effective health policy. Health planners need such information to plan and set priorities for intervention strategies to improve early child health.

1.2. **Research Objectives**

Specifically, the objectives of the thesis are to identify:

(i) The private and public determinants of early child health;

(ii) The extent to which the private and public determinants interact and whether interactions are substitutional or complementary.

1.3 Research Question

1) How private and public determinants affect on the early child health?

2) How are interaction effects between maternal schooling level variable and community level variables?

1.4 Research scope

Under-five children are investigated objects of this research. Their anthropometric Z-score (e.g. weight-for-age, height-for-age, and weight-for-height) are used as proxies for their health and nutritional status. Data is used in this study mainly from Young Live Survey 2006.

1.5 Research Methodology

This research will apply quantitative method to answer two research questions. Multivariate regression model is used as quantitative method for identifying the significant determinants as well as successful health/nutrition intervention program for planning an effective early children development programs in the future.

1.6 Thesis Structure

This study is organized into 5 chapters. Except the introduction chapter, the rest of this study consists of 4 chapters with the outline as follows;

Chapter 2: Literature Review. This chapter starts with definition of children, child health, and child health's measurement. Theoretical framework as well as empirical studies relating to child health and nutrition will be reviewed then. Finally, analytical framework with suggested multivariate regression model is presented.

Chapter 3: An overview of Child Health in Vietnam. The background of child health and nutrition in Vietnam will be discussed further based on dataset of Young Lives Survey.

Chapter 4: Empirical Analysis of Child Health in Vietnam. This chapter starts with variable description. Finally, the regression model, estimation strategy, regression results, and their interpretation will be presented. This chapter also summarizes the findings of this study as well as some policy recommendations.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Child healthy concepts, its measurements and its determinants have been reviewed in this chapter. Firstly, this chapter starts with definition of child health in section 2.2. Measurements of child health are introduced in section 2.3. Theoretical and empirical framework will be surveyed in section 2.4 and 2.5. And then, based on section 2.4 and 2.5, we constructed the analytical framework of this study in the next section. Finally, summary of the literature review is presented in section 2.7.

2.2 Definition

2.2.1 Children

Children are often defined as a human being at the age of 18 and under. However, child may be classified according to different age group or other criteria for research purpose. In Methodologies to Evaluate Early Childhood Development (ECD) Programs published in 2007, World Bank delineate three life-cycle stages: pre-schooling age (under 5 or 6) as the first stage, schooling age as the second stage, adulthood age as last one. This classification used to evaluate short-term, medium-term, long-term impacts of ECD programs respectively. In addition, child's development in the first 5 year of life is very important because vital development occurs in all domains (Grantham-Mc Gregor et al., 2007). For the purpose of this research, early child in this study are limited at pre-schooling age.

2.2.2 Children's health

In the report "Children's Health, the National Wealth: Accessing and Improving Child Health" (2004), U. S Committee on Evaluation of Children's Health defined child health as:

"The extent to which individual children or groups of children are able or enabled to (a) develop and realize their potential, (b) satisfy their needs, and (c) develop the

capacities that allow them to interact successfully with their biological, physical, and social environments".

They also further defined three distinct but related domains of health: "health conditions", which reflects the child's health status physically; "functioning", which focuses on how health affects child's daily life; and "health potential", which captures the development of assets and positive aspects of health, such as competence, capacity, and developmental potential.

2.3 Measurement of children's health and nutrition status

Overall, there are three popular child health indicators e.g. mortality, morbidity and anthropometry.

2.3.1 Mortality

Child mortality has been frequently used, primarily because it is relatively easy to measure. However, it is a somewhat gross health indicator because it provides a little information about the specific cause of death. To overcome this shortcoming, child mortality is classified into the subgroups (table 1). The classification of mortality rates is worth for providing appropriate health policies because each sub-group experiences different potential risks of death. For instance, neonatal mortality is mainly caused by the medical technology and basic health care, whereas the others are more relied on nutrition, hygiene, health-care practice, etc.

Table 1: The subgroups of child mortality

Subgroups	Age period	The way to calculate
Neonatal	Birth- month 1	The number of deaths per 1,000 births
Infant	Birth-1 year	
Under-five child	Birth–5 years	
Post-neonatal	Month 1-12	The number of deaths per 1,000 survivors
Child	1–5 year(s)	

Source: (Rutstein, 2000).

Nevertheless, due to retrospectiveness of this indicator, deaths tend to be under-reported in developing countries, especially more in group of mother with low socio-economic status (Strauss and Thomas, 1995). Furthermore, child mortality doesn't provide information about the incidence or acuteness of specific diseases of the living child.

Thus, this information might be critical in assessment of the impact of ill-health as well as for policy evaluation. Hence, researchers and policy makers have more recently turned to morbidity indicator.

2.3.2 Morbidity

Child morbidity are calculated as percentage (the number of children affected per thousand or per million persons at a point or period of time) in term of incidence and acuteness of illness. Moreover, this indicator is classified into self-perceived and observed morbidity. Self-perceived morbidity is relied on the self-evaluations of the respondents. Observed morbidity is the records of health status based on the judgments of trained physicians. However, the severity of illness can vary according to the people's perception that may lead morbidity is over-reported or under-reported. Higher socio-economic status may be positively associated with the probability of reporting an illness; for the respondents have better information, and greater awareness, and perhaps more experience with health-care providers. All explains that why developing countries have lower reported-morbidity than developed countries. Consequently, the shortcomings of mortality and morbidity have motivated researchers to find more "objective" indicator of child health. There is a long tradition of using anthropometry as indicators of nutritional status and child health. The following section will be discussed it in details.

2.3.3 Anthropometry

The calculation of anthropometric indicators based on physical body measurements. Three anthropometric indicators (height-for-age, weight-for-height, and weight-for-age describing different aspects of malnutrition), commonly expressed as Z-scores, are often used to reflect physical development or nutritional status of children (WB, 2007a). The Z-scores can be calculated by using the standard for well-nourished children of the World Health Organization/National Center for Health Statistics/Center for Disease Control (WHO/NCHS/CDC) as International Growth Reference. For example, the weight-for-age Z-score for a child i in age and gender group c can be constructed as $Z_i = (W_i - \text{Median}W_r)/\sigma_r$, where W_i is the measured weight of the child, Median W_r and σ_r are the age- and gender-specific median weights and standard deviation of weights, respectively, of well-nourished children (reference children).

_Height-for-age: this is a cumulative or long-term indicator of physical growth because it reflects present and past nutritional status. Stunting is a deficit in the height-for-age indicator, reflects a child's process of slow growth in height compared to that of a reference healthy population. In developing countries, stunting, which reflects chronic malnutrition, is caused primarily by repeated episodes of diarrhea, other childhood diseases, and insufficient dietary intake (Glewwe et al, 2002). Stunting is usually not reversed, or children who become stunted typically remain throughout their lives and thus never "catch up" their potential development. Thus, the WHO recommends it as a reliable measure of overall social deprivation or long-run social conditions (WHO, 1986).

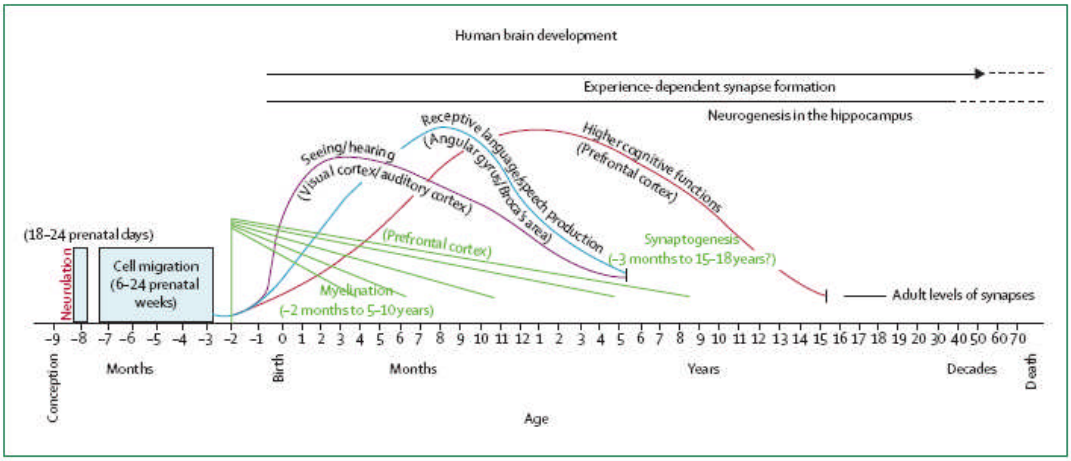
_Weight-for-height: in contrast, this is short-term indicator of physical growth. Wasting (abnormally low weight-for-height) is an indicator of current malnutrition. The weight loss due to wasting can be restored quickly under favorable conditions. Therefore, wasting is particularly useful indicator in describing the current health status of a population and in evaluating the benefits of intervention programs since it responds more quickly to changes in nutritional status than does stunting. However, a disadvantage of this index is that it classifies children with poor growth in height as normal.

_Weight-for-age: underweight (abnormally low weight-for-age) can reflect stunting, wasting, or both. While it is commonly used in monitoring growth in children under five, its interpretation is more difficult since it does not distinguish between acute and chronic malnutrition.

Some researchers poses that anthropometry are physical growth indicator, whereas health demand as behavioral decisions are made on the basis of health perception. They argues that self-reported health measures (for example: morbidity and mortality) may be appropriate for analyzing. However, well-nutrition is necessary condition for vital development occurring in all domains within the first 5 year of life (Grantham-Mc Gregor et al., 2007). For instance, the most rapid development of children's brain takes place during this period (see Figure 1). If children are under-nourished, they will fail to attain their potential growth typically and will be at the riskiest of infections that may be lead to child morbidity and mortality. Therefore, we still use three anthropometric

indicators as health proxies of under-five children's health. However, we focus more on two anthropometric indices (stunting and wasting) as recommendation by the works of WHO (1986), since they distinguish between long-term and short-term physiological processes.

Figure 1: Human Brain Development



Source: Grantham-Mc Gregor et al. (2007).

2.4 Theoretical framework related to determinants of children's health and nutrition status

Economic models of household behavior have their roots in Becker's model of household production. The idea of the model is that the household allocates time and goods to produce commodities, some of which are sold on the market, some which are consumed at home and for some, no market exists. We begin with a very simple preference function of the household. For simplicity, we also consider a one-period model under certainty.

$$U = U(H, L, C; X_h) \quad (1)$$

which households are assumed to choose between child health H, leisure L, consumption of goods and services C, X_h is a vector of household characteristics including the education level of the household head and his spouse.

The preference function (1) is maximized subject to two constraints. The first constraint is the child health production function constraint.

$$H = F(HI_i, X_i, X_h, X_c, \eta_i), \quad (2)$$

where HI_i is a vector of household- provided health and nutritional inputs such as nutrient intake, and the quantity and quality of child care, X_i, child's health endowment, that component of child health due to either genetic or environmental conditions that cannot be influenced by family's behavior (or health heterogeneity), X_c community characteristics, X_h family characteristics (such as parental human capital), and η_i represents individual-specific unobservable heterogeneity in health. The works of Schultz (1984) and the study named Methodologies to Evaluate Early Childhood Development Programs published by World Bank in 2007 also used the same conceptual model to access short-term impacts of ECD programs for pre-school children.

In addition, the second constraint is the household full income constraint.

$$P_c C + WL + P_{HI} HI_i = FI \quad (3)$$

where P_c, W, P_{HI}, are the price vectors of consumption goods, leisure and health inputs, respectively, and FI is full income including the value of the time endowment of the household and non-labor income.

Moreover, Glewwe et al. (2002), a co-author of Methodologies to Evaluate Early Childhood Development Programs, classified a wide variety of health and nutritional inputs (HI_i) including prenatal care, breast milk, infant formula, all other foods, medicines and medical care. In addition, the quality of the household's drinking water, toilet facilities and other hygienic conditions around the home can be treated as health inputs. Even though researchers would often like to estimate a health production function (2), it is almost impossible to collect HI_i data because it requires detailed information on a large number of health inputs not only for the current time period but for all past time periods of the child's life. This incompleteness may well lead to serious problems of omitted variable bias. A more practical alternative is to substitute out these health inputs by their determinants. Glewwe et al. (2002) suggest health and nutritional inputs that households choose for their children are determined by the household income level (FI), mother's and father's schooling, number of children in the family, their preference for child health (P_i), the health environment (X_c) and the child's genetic health endowment (X_i). Glewwe et al. (2002) also mentioned number of children in the family as determinants of health inputs because he assumed that there is a quantity-

quality trade-off in children. Therefore, our reduced form function for child health is constructed by combining the work of Schultz (1984), and Glewwe et al. (2002).

$$H=\Phi (X_i, X_h, X_c, FI, P_c, W, P_{HI}, \mu) \quad (4)$$

whereby the particular functional form of the function $\Phi(.)$ depends on the underlying functions characterizing household preferences and the health production function. Estimates of the reduced form of (4) are obtained using the following regression function, with X_c is expanded to include price of consumption goods (P_c) and health inputs (P_{HI}) and wages (W):

$$H_i = \beta_0 + \beta_1 X_i + \beta_2 X_h + \beta_3 X_c + \beta_4 FI_h + \eta_i \quad (5)$$

2.5 Selection of variables included in the model

2.5.1 Child variables (X_i)

Child characteristics are representative by age, gender (since girls are typically healthier than boys, sex discrimination don't take place). Glewwe et al. (2002) find out diseases (mostly diarrhea) occur frequently during the first two year of life's Vietnamese children. The consequence of diarrhea, other illnesses and inadequate food intake leads to low weight gain in short-run and low height gain in long-run. Glewwe et al. (2002) and David et al. (2004) use contracting of diseases occurring frequently in commune (for example diarrhea) in the last 15-30 days to reflect propensity to illness. We use dummy variable Healthiness based on self-perceived health comparison between respondent's child and reference children with the same age (that equals 1 means Young Lives child's health is the same, or better; otherwise is worse). This dummy variable reflects parental perception of their children's health.

2.5.2 Household Variables (X_h)

This section discusses household factors that shape and modify the economic choices and health-related practices of individuals according to the cultural traditions and norms of the society. They also are key determinants of nutritional and care-seeking practices, and clearly associated with socioeconomic level.

a. Age of parent

Economists posited that mother has, typically, most responsibility for child nutrition and health. While in most traditional societies the mother has full responsibility for child care, she may have little control over allocation of household's resources (food) to herself or her child or over critical child-care practices (diet, sickness care). Often decisions in these areas are reserved for the elders, particularly the mother-in-law or the husband. Some variables such as age of father and mother, and age difference of parent reflect the power relationships of child's mother within the household. Young mother is assumed tend to be less experienced in child care. The last variable may reflect the relative situation of her strength, whereby a high age difference may mean more limited capacity for decision making.

b. Schooling level

This study uses the level of education of parent introduced as a continuous variable. Better educated parents are assumed to be more successful at protecting or improving their children's health status (holding everything else constant). In the work of Strauss and Thomas (1990) in some regions of Brazil, parental education has a significant positive effect on child anthropometric outcomes, especially height for age. For example, in the urban Northeast of Brazil, children of mothers who have completed primary school are 2.5 percent taller than those of illiterate mothers. On the whole, the effect of parental education on child health may be through pathways as following:

b.1 Increasing income: particularly in the urban sector, parental education are usually associated strongly with occupation, and therefore with family income (Mosley and Chen, 1984). And then, parent might be expected to invest more resources in the child health production and thus would have wealthier children.

b.2 Allocative, and technical efficiency (or better processing of information):

Because of biological links between the mother and infant during pregnancy and the most vulnerable stages of child's first five years, the mother's education level affect only her health and nutritional status, but also her child's health by influencing her choices and increasing her skills in health care practices related to nutrition, hygiene, preventive care, and disease treatment. Economists have usually posited that education affects production of child health by raising the technical efficiency with which inputs are used or by increasing the allocate efficiency of input use as early hypothesized by Grossman (1972). Reduced form estimates typically reflect the influence of both allocative and technical efficiency.

Thomas, Strauss and Henriques (1990) explicitly examine the extent to which the effect of parental education on child height and survival (their proxy for health) in a Brazilian sample. They begin with a specification that excludes all household variables, first add household non-labor income then instead add per capita household expenditure (both as valid instrument variables for family income). However, as instrumental variable added, the parental education still significantly positive effect on child health status. However, the magnitudes of the maternal education coefficients do not decline or decline slightly; whereas effect of father's education decrease with up to declines of 30 percent. Similar results are reported using a different dataset from the Brazilian Northeast in Thomas, Strauss and Henriques (1991). This strongly suggests that, in Brazil at least, both parents play an active role in the production of child health. Moreover, the effect of father's education does operate through income more than that of mother. Thus, it is consistent with the assumption that mother mostly reserves responsibility for caring her child.

More educated mothers maybe have healthier children because they have better information on the optimal allocation of health resources, and thus are able to produce health at lower cost. Thomas, Strauss, and Henriques (1990) also find that nearly all the impact of maternal schooling on child height (their proxy for health) could be explained by access to media, and that schooling and community health services are substitutes. Glewwe (1999) use Moroccan data to find out maternal health knowledge is gained largely outside the classroom. Education provides women the ability to understand and adopt new methods of child care conveying through media. This suggests that more educated people are more efficient consumers of information.

b.3 Opportunity cost of time:

The production of a healthy child also requires a mother's time for prenatal visits, attendance at the well-baby clinic, breastfeeding, food preparation, washing clothes, bathing the child, house cleaning, and sickness care. A mother's time may also be required for (or diverted to) other economically productive activities that may or may not be related to child health. In traditional societies, a sharp division of labor by sex tends to maximize the mother's time for child care. On the other hand, in transitional society, child care time often competes with time needed for income-generating work. The consequences for infant health and mortality depend largely on the general economic circumstances of the household.

More educated women may assign a higher opportunity cost of time if they work in the market and receive a higher wage rate., that tends to increase the time mother spend working outside the home and thus reduce time for child care and duration of breastfeeding. Consequently, if mother's time is an essential "input" in the production of child health, education could then negatively related to the health of children.

b.4 Preferences:

Education provides women the ability to understand the information of modern scientific medicine. When the mother is exposed to such information, it can transform her preferences for health care practices to significantly improve child health. Educated mothers tend to opt for fewer but healthier children (Glewwe, 1999). Taking an example from the child health literature, the Cebu Study Team (1991) traces through the effect of maternal education on the incidence of diarrhea among children from birth to 1 year. The reduced form estimates show that a one-year increase in maternal education lowers diarrhea incidence by 5 percent.

Father's education is a strong determinant of the household assets and also influence attitude and thus preferences in choice of consumption goods, including child care services (Mosley and Chen, 1984).

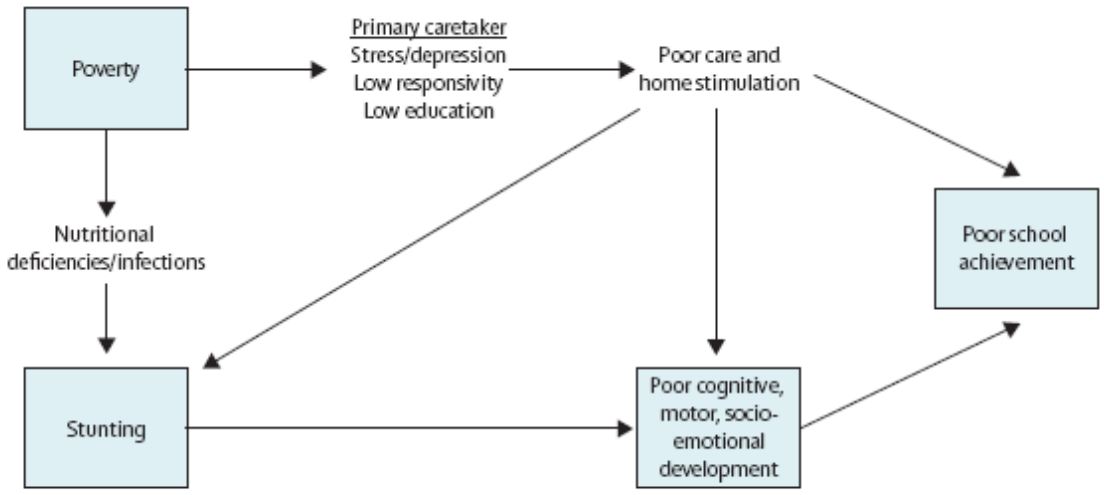
c. Parental taste for their child health

Glewwe et al. (2002) use dummy variables representing different ethnic groups evaluate parental tastes for child health in Vietnam. Teerawichitchainan and Phillips (2008) find

out ethnicity impact significantly on parental health-seeking for childhood illness in Vietnam.

d. Poor

Figure 2: Hypothesized relations between poverty, stunting, child development, and school achievement



Source: Grantham-Mc Gregor et al. (2007).

Poverty is associated with inadequate food, and poor sanitation and hygiene that lead to increased infections and stunting in children. Poverty is also associated with poor maternal education, increased maternal stress and depression, and inadequate stimulation in the home. All these factors negatively affect child development & child's school achievement in long-term (Figure 2).

e. Parental endowment

The child's genetic health endowment may play an important role in differences in health among children. We should include the height of parent to reflect variation in child's genetic endowment as Glewwe et al. (2002).

2.5.3 Full household income (FI)

Some economists use the earnings of the husband (or father) as exogenous proxy for household income under the assumption that the man's time allocation is not endogenous in human capital investment decisions. This is a convenient but strong assumption and implies both that the father does not participate in the production of child human capital and that household preferences are separable in father and mother leisure. However, Thomas, Strauss and Henriques (1991) argue that in Brazil at least both parents play an active role in the production of child health. Nowadays, women also participates the labor market and contribute to household income.

For full household income, the works of Glewwe et al. (2002), David et al. (2004), and (Thomas and Strauss, 1990 & 1995) state some shortcomings of full household income that lead biased estimates

(i) Full household income may not be accurately reported. Respondents may be unwilling to reveal their income; income from self-employment (including income from rural enterprises) is hard to measure; if only one person in each household is surveyed, then that person may not even know how much income is received by all members. Unfortunately, few studies have explicitly paid attention to the problems of measurement errors.

(ii) Full household income (especially cash income) may be irregular in nature.

(iii) Total household income is inappropriate if female time allocation is likely to be endogenous. In general, the child’s mother makes decisions about their children's health at the same time that she makes decisions about income earning activities. If her children were ill, she would decide to purchase costly medicines or medical services, and she would

work more hours to pay for those medicines. Alternatively, the mother may reduce hours worked work fewer hours in order to spend more time caring for her child.

There is some evidence that stock measures of child health (e.g. height or height-for-age) are positively affected by measures of long-run resources (permanent income). While these effects are significant, their magnitudes are typically fairly small. Short-term measures of income typically have an even weaker impact on stocks of child health. In contrast, short-term measures of health (e.g. weight-for-height) are more responsive to current income but not to permanent income. However, these results are far from universal and the fact that there are mixed empirical results.

Thus, Glewwe et al. (2002) and David et al. (2004) state that it would be preferable to use the natural logarithm of annual household expenditures per capita (defined as the sum of expenditures on food, and miscellaneous goods and services divided by the total number of household members) as proxy for full household income. This indicator is likely to be accurate, as well as better reflect average-over-time situation or a households "permanent income" because it may be change a little over time.

2.5.4 Community variables (X_c)

The definition of "community" is seldom clear and is often driven by data. Some studies measure variables at the local community level, with data collected independently from the household, whereas some use community-level variable aggregated from household data. As an example, Thomas, Lavy and Strauss (1992) use independently collected community data at the village level for rural areas in Côte d'Ivoire, while for urban areas they aggregate local areas within a city on the assumption that travel opportunities within cities are much better than between rural villages. However, the later approach is argued that household data is affected by unobservable unobserved characteristics (such as tastes) that lead to endogeneity. Therefore, in this study, we attempt to use community data collected independently from the household as most previous studies. In this section, community variables are classified according to subgroups: infrastructure, price, public intervention program.

a. Infrastructure

In reality, households with higher income tend to live in less crowded areas with better hygiene, cleaner water, and better health care services. Thomas, Strauss and Henriques (1991) after controlling for community variables, the effect on child height of per capita household income reduces by over half and it becomes insignificant. However, parental education effects remain in that study. If education enables people to process information better and if this leads to improvements in both technical and allocative efficiency, then education also conditions the effect of community infrastructure used by household on child investments. More education may also be related to the quantity and quality of public services available to the household.

Strauss (1990) shows that having piped water in rural Côte d'Ivoire is associated with greater height and Thomas and Strauss (1995) show that children are taller in urban Brazil in areas that have more buildings with sewerage hookups and electricity. Moreover, the use of different infrastructure (such as good quality water, sanitation or the local health facility) is likely to depend on household resources (including education) and will often be related to unobserved characteristics (such as tastes). Therefore, the use of community services might be endogenous in human capital investment decisions. Thus, recent studies prefer to use the availability of instead of use of public health infrastructure. David et al. (2004) use proportion of households with water tap (or flush toilet, washable latrine) within the house as proxy for availability of public health infrastructure. Because, data of proportion of households with water tap (or washable latrine) is missed in Young Lives dataset, we only use proportion of households with flush toilet with assumption what household having flush toilet that will use tap water.

b. Price

Prices measured as unit costs from household expenditure data may be endogenous if prices reflect quality variation. Price measured at that community level could be treated as exogenous and may be preferred.

b.1 Food price (price of consumption goods) P_c

Pitt and Rosenzweig (1986) provide an early study which measures food price impacts significantly on the probability of Indonesian adults reporting an illness. Higher sugar and dairy prices are associated with lower child heights in Brazil (Thomas and Strauss, 1992), whereas in rural Côte d'Ivoire (Thomas, Lavy and Strauss, 1993) food prices do not have significant effects on child heights. We used the price of rice (basic staple food), as well as the price of an item more directly related to child health and nutrition as powdered milk to reflect the costs of obtaining basic inputs for nutrition.

b.2 Price of health inputs (P_{HI}) and availability of health inputs

Since user fees for medical facilities and price of health inputs often are hard to collect because it requires detailed information on a large number of health inputs, measures of service availability may be preferred. These include distance or travel time to the nearest facility, or the number of facilities or staff (e.g. doctors). If people travel beyond the nearest facility because there are important quality differences, then local measures of availability are not appropriate and the notion of "community" will have been defined too narrowly.

However, the evidence of the relation of distance to health facilities with health outcomes is ambiguous; for instance Strauss (1990) shows that distance to facilities are associated with child height or weight for height in rural Côte d'Ivoire, while Barrera (1990) shows the expected inverse relationship in Bicol Province, Philippines. However, distances are particularly difficult for respondents to measure accurately, and thus may suffer from random measurement error.

b.3 Wage

High wage tends to increase the time parent spend working outside the home and thus reduce time for child care. In this study, we clarified wage into subgroup: agricultural

wage for male (female) and nonagricultural wage for male (female) to access their impact on child health.

c. **Public program intervention**

Schultz (1984) summarize the role of public programs in affecting health that estimated by the demand equations for health.

1. They may reduce the prices of the health inputs, directly through subsidization of the goods or services, or directly by increasing access to them, thereby reducing the time ad travel costs to evaluate and use the service.
2. They may provide information on how to produce health more efficiently. This might include information on new inputs or on efficient practices with traditional health inputs.
3. They may improve the healthiness of environment that benefit for all persons living in an impacted area, regardless of their economic status and educational attainment.

2.5.5 Community variables and interactions with mother's education

The estimates of maternal education & community variables (including public intervention program) on child health are likely to be misspecified, if their interactions are ignored (Christiaensen and Alderman, 2006).

Caldwell (1979) hypothesizes and offers some evidence that more educated women are better able to understand information in the media as well as from medical and public health personnel. Thus, he concludes more educated women benefit more than uneducated women from better infrastructure. Caldwell provides limited evidence that medical personnel spend more time with better educated patients. In contrast, Rosenzweig and Schultz (1982) argue that the benefits of health infrastructure and the information provided will be greater for the least educated, which seems plausible if the underlying health messages are easily understood and targeted towards the poorest.

Schultz (1984) summarize a final set of hypotheses relates to the relationship between parental education and health/nutrition intervention program. He indicated the effects of program interventions may differ depending on the mother's education, according to the relative importance of influence pathways of education on health (discussed above).

Table 2: Who benefits more from health program interventions, according to the roles of the programs and of mother's education

Role of mother's education	Roles of health programs		
	Information raises technical efficiency	**Modern input subsidy encourages use**	**Improvement in healthiness of environment**
	(A)	**(B)**	**(C)**
1. Increase productivity of health inputs	Unknown	Unknown	Less educated
2. Reduce costs of information on technology	Less educated	More educated	Less educated
3. Increase family income	Unknown	More educated	Less educated
4. Increase mother's price of time	Unknown	Less educated	More educated
5. Effect preferences for health	Unknown	Unknown	Unknown

Source: Schultz (1984)

In case that health programs provide information to raise technical efficiency, if the health messages is translated to be easily understood, less educated mother may benefit. If health programs encourage use modern input use by subsidy, more educated mother may be more likely to adopt sanitary, nutrition or health practices which are conducive to child growth. In these cases, health programs will complement the effect of maternal education on child health. On the other hand, illiterate mothers & educated mother may benefit from health programs which tend to improve healthiness of environment. Moreover, illiterate mothers may benefit from good (or large) clinics and publicly provided services, in which case education and infrastructure would be substitutes. Clearly, the magnitude and sign of these interactions is an empirical issue; there is no clear consensus about them.

2.5.6 Endogenous program placement and selective migration

The estimates of program and other community characteristic impacts just discussed might be biased by two sources discussed in the literature: purposive program placement and selective migration.

Purposive program placement that means NGOs and public health facility placement is possible non-randomly determined. For example, public health facilities were placed in the less healthy areas. In the absence of perfect measurement of the health environment, clinics will appear to be less effective than they are in reality. Rosenzweig and Wolpin (1986) find that health facilities other than hospitals and clinics are associated with higher child mortality, and both Thomas and Strauss (1995) as well as Thomas, Lavy and Strauss (1992) show similar relationships between nurses per capita and child height in Brazil and Côte d'Ivoire respectively. Indeed, observing a negative correlation between numbers of nurses and health outcomes might be construed as indicating that nurses make people less healthy; but the correlation may, in fact, reflect effective targeting of public investments. The implications of these two interpretations for public health policy are completely different and so it becomes important to understand the mechanisms underlying program placement. This is an area that has been under-explored in the socio-economic literature.

Selective migration: effectiveness of specific-located health/nutrition program or better environment of community could attract people with selectively different tastes for the particular service or endowment level (Rosenzweig and Wolpin, 1988). For instance, if residential location is related to better quality of local schools will attract families with unobserved higher tastes for education.

The standard solution is to use statistical procedures to compare changes in outcomes of pre- and post-program for experimental and control groups (or areas with and without a program/policy). This may be accomplished by using individual-level longitudinal data with individual fixed effects as Rosenzweig and Wolpin (1986), or by aggregating individual-level observations into time series-cross section data and using community-fixed effects Pitt, Rosenzweig and Gibbons (1993), Glewwe et al. (2002).

2.5.7 Endogenous explanatory variables

It is critical to determine insights what types of factors should be treated as exogenous, as opposed to endogenous in the conceptual model. Strauss and Thomas (1995) summarize that some studies' viewpoint treated factors over which the household has control as endogenous variable. However, they critiques such guidance is seldom unambiguous because what variable would consider to be endogenous that is conditional on the model assumptions. For instance, Rosenzweig and Wolpin (1988) assume that if a household chooses its location based on services available in a community, then any variables related to characteristics of services (such as the quality of child health services) should be treated as endogenous variable. Furthermore, Wooldridge (2002) denotes endogeneity arise from omitted variable, measurement error, and simultaneity. Strauss and Thomas (1995) argue simultaneity is mostly cause of endogeneity. In other word, what explanatory variables are possibly affected by changes in the dependent variable (child health). By the way, previous similar studies denote full household income FI (the annual consumption expenditure per capita is proxy variable); household size or number of children in the family is treated as endogenous explanatory variables. However, the work of David et al. (2004) in Nicaragua and the Western regions of Honduras consider endogeneity of number of children variable is small due to the fact that most families in those regions do not really plan the number of children they would like to have, for cultural and religious traditions. Therefore, it should not to be a good strategy as blind reliance on theory. Thus, empirical study requires judiciousness and flexibility in a particular application.

a. Number of children in the family

The number of children in the family assumed to be affecting the health status of children, as large families might have major problems taking care of all siblings (David et al., 2004). With fewer children, the mother would be able to allocate more time and more health inputs per child (Glewwe, 1999). Therefore, some authors consider the quantity-quality tradeoff in children is more likely to occur in developing countries rather than in developed countries (Li, Yang, and Yu, 2005)

Glewwe et al. (2002) state it is clearly endogenous explanatory variable. It is caused by two sources of endogeneity. Firstly, Quian (2005) mentioned heterogeneity in the quality of the first child, in other words, parent tend to alter their fertility decision on the

basis of changes in the health/nutritional status of already born children. For example, parents are more likely to have a second child when the health of first child is good. Secondly, another source of endogeneity arises from parental heterogeneity (Li, Yang, and Yu, 2005; and Quian, 2005). For example, parents with high schooling level may prefer to have fewer children. However, David et al. (2004) argue that the endogeneity of this variable will be small when family does not really plan the number of children they would like to have. But in Vietnam, family planning is so wide-spread and women can access to effective birth control, number of children has more endogenous characters.

b. Full household income

For full household income variable (the annual consumption expenditure per capita is proxy variable) Glewwe et al. (2002) mention two reasons. Firstly, in general, households make decisions about their children's health at the same time that they make decisions about income earning activities. Parents whose children are ill may decide to purchase costly medicines or medical services, and to do this some household members may work more hours to pay for those medicines. Alternatively, household members may reduce hours worked because of a child's illness, for example the mother may work fewer hours in order to spend more time caring for the child. Secondly, as mentioned above, we use annual consumption expenditure per capita as proxy variable. However, even this proxy variable may have a significant amount of measurement error, much of which will be random.

If endogenous explanatory variables and exogenous variables are estimated by OLS, all of estimates will be biased and inconsistent. Some authors consider controlling for endogenous explanatory variables by using instrumental variables. Based on Woolbridge (2001), the plausible instrumental variable in our regression model should meet two conditions: (i) instrumental variable are correlated (positively or negatively) with endogenous explanatory variable, (ii) instrumental variable are uncorrelated with the disturbance term in the second-stage regression model.

c. Validity of instrumental variables

In the place of FI proxy variable, in theory, to avoid simultaneity bias, one could include in their regression only nonlabor income or the value of household assets.

Thomas, Strauss and Henriques (1990) use household non-labor income as instrumental variable for household income. David et al. (2004) used two categories of instrumental variables such as household assets and characteristics of dwellings as proxies for the value of household assets. Glewwe et al. (2002) used two categories of instrumental variables are types of agricultural land allocated to the household (irrigated annual cropland, un-irrigated annual cropland, perennial cropland, water surface) and non-labor income (from social funds, social subsidies, dowries, inheritances, lottery winnings, and remittances sent by overseas relatives). However, father's education is a strong determinant of the household assets and also influence attitude and thus preferences in choice of consumption goods, including child care services (Mosley and Chen, 1984). Therefore, we use the area of land owned by household and household nonlabor income as instrumental variable of full household income.

It is difficult to find plausible instruments for number of children variable. Glewwe (1999) used three categories of instrumental variables: the number of married sisters of both the woman and her husband which could reflect preferences for children on both sides of the family, the education levels of woman's parents which may reflect family preferences for children, and finally the age of the woman since older women will have had more time to bear children. Following Rosenzweig and Wolpin (1980), (Li, Yang, and Yu (2005) use child characteristics (including age, gender, ethnic group, and place of residence), and parental attributes (including age and education level) as instruments for family size. We will apply most of plausible categories of instrumental variables (except the number of married sisters of both the woman and her husband and the education levels of woman's parents) because such information is available in Young Lives dataset.

2.6 Analytical framework

$$H_i = \beta_0 + \beta_1 X_i + \beta_2 X_h + \beta_3 X_c + \beta_4 FI_h + \eta_i (5)$$

where:

- $H_{i\,h}$ is the Weight-for-Age, Height-for-Age or Weight-for-Height Z-score for the i^{th} child in the h^{th} household;

- $X_{i\,h}$ includes variables such as: age, sex, mother's height, perceived-healthiness of child;

- X_h consists of household characteristics including education level of parents, age of parents, age difference of parents, household size; number of children.

- FI_h is the household predicted income measured by the per capita household expenditure and controlling for endogeneity through instrumental variables;

- X_c : as Glewwe et al. (2002), and David et al. (2004), X_c is expanded to include prices of consumption goods and health inputs and wages that may vary across communities. Based on initial dataset of community observed variables in Young Lives dataset, some were selected as community variables that are grouped in several categories.

- Public health infrastructure: proportion of household have flush toilet.
- Economic situation: We used the price of rice (basic staple food), as well as the price of an item more directly related to child health and nutrition as powdered milk to reflect the costs of obtaining basic inputs for nutrition.
- Health care services: we use the average distance (in minutes) to state-run health centre, private hospital/clinic, public/private dispensary, fertility public clinic to represent the access to health services
- Presence intervention public programs as Christiaensen and Alderman (2006), and David et al. (2004).

Equation (5) is calculated in two ways: first using the individual community variables included in Xc

$$H_{i\,h} = \beta_0 + \beta_1 X_{i\,h} + \beta_2 X_h + \beta_3 X_c + \beta_4 FI_h + \eta_i (5a)$$

Then, with community fixed effects:

$$H_{ih} = \beta_0' + \beta_1' X_{ih} + \beta_2' X_h + \beta_3' X_c + \beta_4' FI_h + u + \eta_i' (5b)$$

In order to determine the contribution towards the community profile and the significance of community level observed variables, fitted values of community fixed effects are then regressed on all available community level observed variables

$$\hat{u} = \lambda Z_c + \eta \ (6)$$

where $\hat{u}$ are the fitted values of community fixed effects and Z_c is a vector of all observed community variables.

A second regression analysis is conducted afterwards, looking for interaction among selected household characteristics and community level variables. Household variables used to build interaction variables are schooling level of mother. Equation (5) then becomes the following regression function:

$$H_{ih} = \beta_0 + \beta_1 X_{ih} + \beta_2 X_h + \beta_3 X_c' + \beta_4 FI_h + \delta (X_h * X_c') + \eta_i (7)$$

As before, equation (7) is regressed without community fixed effects

$$H_{ih} = \beta_0 + \beta_1 X_{ih} + \beta_2 X_h + \beta_3 X_c' + \beta_4 FI_h + \delta (X_h * X_c') + \eta_i (7a)$$

then with community fixed effects

$$H_{ih} = \beta_0' + \beta_1' X_{ih} + \beta_2' X_h + \beta_3' X_c' + \beta_4' FI_h + \delta (X_h * X_c') + u + \eta_i' (7b)$$

Again, in order to determine the significance of community level observed variables, fitted values, of community fixed effects, are regressed on all community level observed variables.

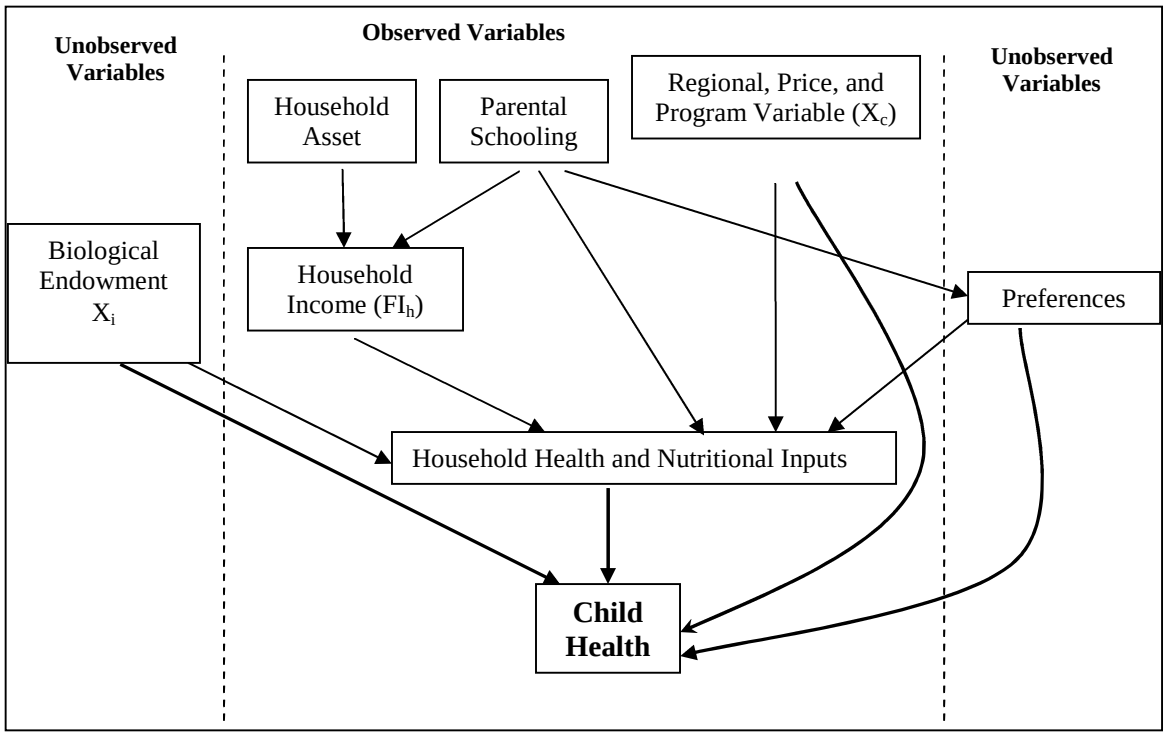
$$\hat{u} = \lambda Z_c + \eta \ (8)$$

where $\hat{u}$ are the fitted values of community fixed effects and Z_c represents all the community observed variables.

A significantly negative value for δ would suggest that mother's education and health program may be substitutional, and that such program may help low-educated mothers overcome their difficulties, or children of low-educated mothers derive greater benefits from the program. Ideally, the right side of Eq. (5) and (7) should include exogenous independent variables. As mentioned before, household expenditures, number of children could be considered as endogenous explanatory variables. The results of eq.

(5b) and (7b) estimated by OLS method with controlling possible endogeneity by their instrumental variables. With multiple instruments, the IV estimator is also called the two stage least squares (2SLS) estimators. Figure 3 present influence pathway of factors on early children health.

Figure 3: Influence pathways of determinants of child health



Source: Constructed by author

2.7 Summary

This chapter presents literature review of child health determinants. Child-for-age, weight-for-age and weight-for-height are proxy variables of health indicators. Four variable groups: child, household characteristics, community factors identified as explanatory of child health. In general, child age, gender, maternal height, education, ethnicity and age of parents, household income is private determinants of child health. The next chapters will present further analysis of private factor's effect on child health outcome.

CHAPTER 3
OVERVIEW OF CHILDREN'S HEALTH IN VIETNAM

3.1 Introduction

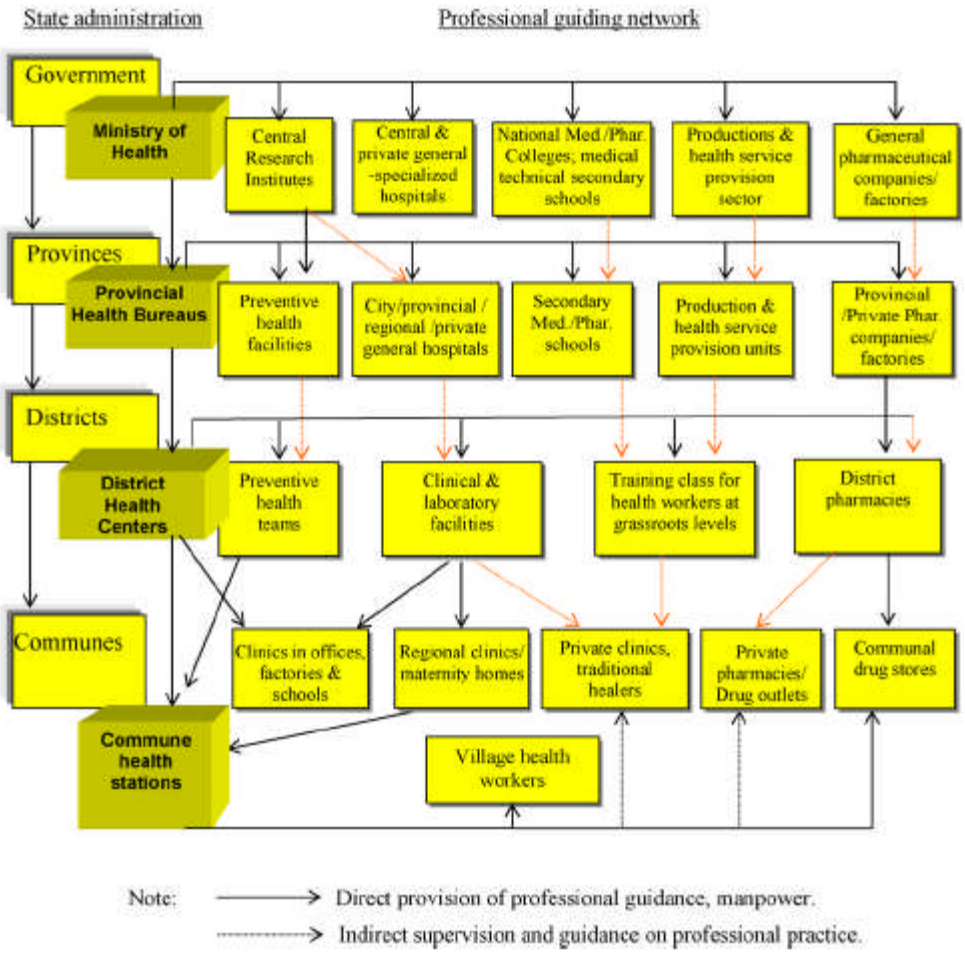
This chapter starts with a review about the situation of children's health in Vietnam, together with efforts of government to issue policies as well as national programs to improve Vietnamese children's health status in section 3.2. The next section 3.3 give some discusses on nutritional status of Vietnamese early children based on data of Young Lives Survey in 2006. Summry will be presented in last section.

3.2 Review on policies and national programs relevant to children's health

Child malnutrition is pervasive in almost every low income country. Among all developing countries, more than 200 million children (about 30%) under age 5 have failed to reach their potential development because of poverty, poor health and nutrition, and deficient care (Grantham-Mc Gregor et al., 2007).

The shift from a planned economy to a market economy in the late 1980s, Vietnam has achieved very rapid economic growth in the 1990s. Its annual rate of real economic growth since 1988 has been about 8%, or about 6% in per capita terms (Glewwe, 2002). Most economists have a consensus that economic growth can reduce child malnutrition in developing countries. In 1993, 50% of Vietnamese children under age 5 were stunted (abnormally low height for age). The situation has improved with one fourth of the children was still malnutrition in 2005 (UNICEF, 2006) thanks to economic growth and sustained investment in primary healthcare. Before 1986, the government had started highly effective national programs of immunization and diarrhea control and had built a strong primary health care system down to the commune level. Nowadays, healthcare systems have been established in all communes with certain improvement in human resources, facilities and medicines (Figure 4). In 2007, over 80% of communes and wards in the country had full-time doctors and health workers as opposed to just 65% in 2003.

Figure 4: Organization of the healthcare system in Vietnam



Source: Hoa et al., 2007

Consequently, according to the work of UNICEF (2007 a, b &c) the number of people accessing safe drinking water was increased to 85% in 2005 compared to 65% in 1990. The rate of households with improved sanitation facilities reached 61% in 2005 compared to 36% in 1990. The universal idolization program with over 90% of Vietnamese using iodized salt has recently achieved.

Together with strengthen of health-care system, the national health programs for children also were conducted. Consequently, the health of children in Vietnam have being been improved significantly with fast decrease in mortality, birth-weight, and underweight rates (Table 4)

Table 4: Some basic children's health indicators in Vietnam

Basic target	**1990**	**2000**	**2005**
Infant mortality rate	46%**	23%*	16%*
Under-five mortality rate	53%**	30%*	19%*
Low birth-weight	9.8%**	9%***	8%****
Under-nutrition prevalence, weight-for-age (% of children under 5)	48%**	33.8%*	25.2%*

Source: *WB (2007b), **UN (1998), ***UNICEF (2004), ****MOH (2007)

However, child malnutrition is a critical issue Vietnam. Families in the remote northern regions, rural households, and ethnic families have greater levels of malnutrition than the rest population (Haughton and Haughton, 1997), the situation still have remained Teerawichitchainan and Phillips (2008).

Furthermore, transition of the economy was accompanied by health-sector reforms. In the mid-1980s, the government began to liberalize the health sector through the legalization of private health services, the establishment of a private pharmaceutical industry, and the introduction of user fees at public health facilities. The liberalization of the health sector was intended to decrease dependence of this sector upon government budget as well as to improve the quality of health services towards customer-friendly service provision. Consequently, the private-sector health system, together with pharmaceutical production-retail businesses was expended rapidly. According to the Ministry of Health, in 2001 there were more than 56,000 private health providers operating in Vietnam, mainly medical doctors (48%), followed by pharmacists (32%) and traditional medicine practitioners (17%). This policy was further boosted in 2002 by Government Decree No. 10, which allows public entities to raise revenues through user fees and to manage their incomes and expenditures more autonomously. The Decree is an instrument to move further away from centrally controlled budgets and give local staff more decision-making power over financial and human resources. This move was part of a broader state policy called social mobilization towards fee-based social services. State forecasts of financing requirements for social sectors until 2010 expect up to 15% of necessary resources to be raised from citizens through user fees and charity.

After reform period, the health sector experienced considerable disruption due to unregulated growth of the private sector and diminishing resources for the public sector. Consequently, use of pharmaceuticals and self-medication as health-seeking behaviors increased, especially in urban citizens (Hoa et al., 2007). According to the work of World Bank (2001), only 13.5% of the Vietnamese population is covered by health insurance, and these changes had an adverse impact on the health of the poor. Socio-economic condition differences between rural and urban environments emerged as factors severely restricted the possibilities of poor to access good-quality health-care services. The treatment cost of a poor patient in rural region is more than 20% of the non-food consumption expenditure of the household; if the patient requires admission to a provincial hospital, the cost rises to 44% of the non-food budget of a poor household. To cope with such situations, due to lacking of other income sources except agricultural income, they tend to sell some rice, pigs, and poultry from their farm or borrow from money lenders (or usurer). Such way leads to poorer conditions of household.

In response to these problems, the government revised the user fee policy in the mid-1990s and launched initiatives to address the health needs of the poor, with particular attention to offsetting economic constraints to healthcare access. Two initiatives of the late 1990s that achieved widespread coverage were Program 135 (P135) and the Hunger Eradication and Poverty Reduction Program (HEPR). HEPR mandated the issuance of health insurance documents eliminating or reducing fees charged to beneficiaries at public facilities, in addition to providing micro-credits, subsidized education, and agricultural extension services.

As of 2002, P135 was implemented in 2326 communes nationwide, with beneficiary communes selected on the basis of adversity arising from their remoteness, a poverty rate higher than 30%, and low agricultural productivity (WB, 2004). P135 aimed to improve peasants' livelihoods by focusing on commune-level road construction, electrification, and health facilities. Further, the policy aimed to provide residents of P135 communes with free healthcare at public health facilities. However, a source of revenue to cover healthcare provision was not ensured until 2002, when another health initiative (Decision 139) was launched. In its early years, P135 focused more on investment in commune health station construction than on provision of free care, leading to uneven implementation of local policies and uneven access to free care in

P135 communes. For example, in 2001, 55% of all P135 commune health centers reportedly collected user fees to cover the cost of care (Vietnam Ministry of Health & General Statistics Office, 2003).

Attempts are underway to improve pro-poor health policies. Decision 139, for example, is intended to finance healthcare expenses for the poor in every province of Vietnam, for residents of P135 communes, and for ethnic minority residents in 12 northern and central highland mountainous provinces. A parallel program was subsequently launched to provide free healthcare for all children under the age of 6 years irrespective of their household economic status.

3.2 Nutritional status of Vietnamese Early Children

3.2.1 Data

Data from the Young Lives Survey is mainly used in this study. Young Lives is a long-term research project investigating the changing nature of childhood poverty in developing countries. They are tracking the development of 12,000 children in Ethiopia, India, Peru and Viet Nam through quantitative and qualitative research over a 15-year period. Data from the YL study were used. In each of four countries (Peru, Ethiopia, Vietnam and the state of Andhra Pradesh in India) 20 sites were purposefully selected by a team of local experts to represent a range of regions and living conditions. Random samples of 100 households containing children (6-18 month child and 7.5-8.5 year old child) are chosen in each site. In Viet Nam, they conducted first rounds of gathering data on 3000 children in provinces of Lao Cai, Hung Yen, Da Nang, Phu Yen and Ben Tre in 2002. They conduct second round of survey in 2006 with the same children interviewed in 2002. Quantitative data has been collected on parents/careers and children (covering a broad range of data on incomes, activities, assets, health, education, subjective well-being and psychosocial health), and recently a qualitative sub-study has been initiated, looking particularly at the key transitions facing children (for example as they start school or work) and children's own perceptions of poverty, well-being, risk and resilience. Though the questionnaire aimed to measure items in the same way across the four countries, the variables used to collect this information were adapted for use to provide locally meaningful measures. The full sample details and questionnaire can be

found on www.younglives.org.uk. Because this study aims to investigate the private and public determinants of early child health in Vietnam, we only use data of 4-5 year children gathered in 2006.

3.2.2 Outliers

The indicators of nutritional status are expressed in "z-scores" which are derived by comparing the child's height and weight with that of a "reference" group of well nourished children (WHO, 1995). More specifically the stunting z-score is the difference (expressed in standard deviations of a child's height for age from the median height of children of the same age and sex in the reference population. When working with z-scores, it is important to consider the issue of cut-offs points, i.e. which observations to exclude from the analysis that stem from wrong measurements or erroneous data entry, as outliers can influence the estimation result in a non-trivial way. The World Health Organization (WHO) has defined two different types of limits for acceptable data: on the one hand, it suggests a flexible exclusion range, defined as +/- 4 z-score units from the observed mean z-score, but with a maximum height-for-age z-score of +3.0. The other exclusion restriction is a fixed restriction range for observations with a mean z-score of higher than -1.5, and bounded by a lower value of -5.0 for both weight-for-age and height-for-age, and an upper bound of +3.0 for height-for-age, and 5.0 for weight-for-age and weight-for-height. In this study, we make use of the first way to exclude outliers in our dataset.

3.2.3 Statistical analysis

Table 5 provides the mean Z-scores for the three indicators for children aged 4-5 years, stratified by sex and urban/rural location. The mean Height-for-age Z-score is –0.109, corresponding to a proportion of malnourished children (below – 2 Standard Deviations) of 6.0%. The mean Z-score of urban averages are higher than rural ones (0.51 versus –0.26 respectively). There is significant gender difference: boys scored –0.177 and girls –0.038.

Table 5: Mean of three anthropometric Z-scores for the for children aged 4-5 years

	Urban		**Rural**		**Total**		**Total**	
	Boy	Girl	Boy	Girl	Boy	Girl	Urban	Rural
HFA	0.446	0.581	-0.335	-0.211	-0.200	-0.060	0.515	-0.275
WFA	0.683	0.683	-0.456	-0.321	-0.258	-0.129	0.683	-0.390
WFH	0.997	0.997	-0.727	-0.528	-0.428	-0.238	0.997	-0.631

Source: Calculated by author

We explored in all three anthropometric z-scores is lower in rural areas than in urban areas; gender differences are large in WFA and WFH with low mean z-scores for boys. We explored directly the relationship of growth indicators with other variables of interest, known to influence nutritional status. Table 6 shows the proportion of malnourished children according to 5 quintiles of expenditure per capita.

Table 6: Malnutrition by Expenditure Quintiles

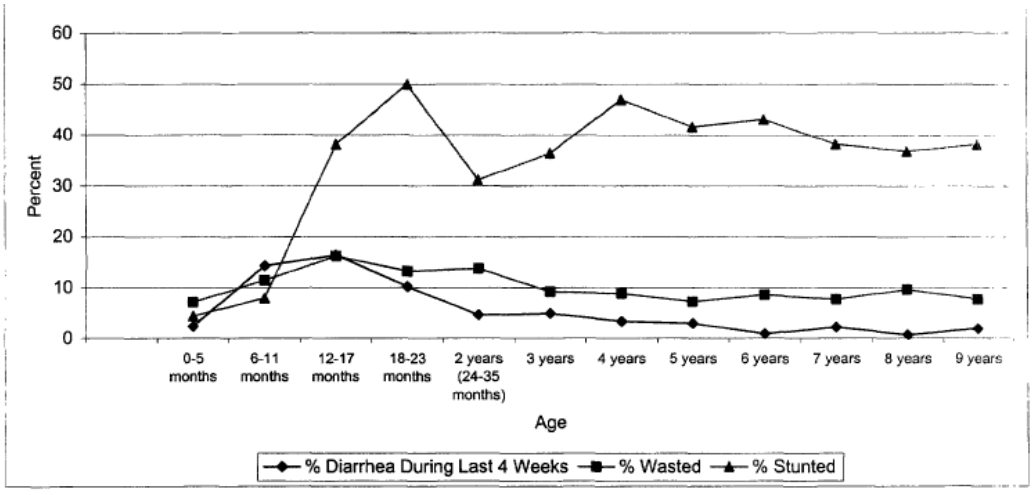
Expenditure per capita	Stunting (2006)	Stunting 97-98 (Glewwe et al., 2002)	Wasting (2006)	Wasting 97-98 (Glewwe et al., 2002)	Underweight (2006)
1st quintile	0.05%	41.3%	0.64%	13.2%	0.00%
2nd quintile	1.28%	42.1%	2.76%	12.4%	0.27%
3rd quintile	1.81%	32.6%	3.93%	10%	0.48%
4th quintile	1.86%	27.5%	3.46%	5.3%	0.27%
5th quartile	1.44%	14.2%	2.45%	9%	0.16%

Source: Calculated by author

The first group, quintile 1, is the poorest. About 0.05% of the children in that group were stunted. The second poorest group, quintile 2, had rate of 1.28%. Quintiles 3, 4 and 5 had higher rates of 1.81%, 1.86% and 1.44%, respectively. This pattern, based on cross-sectional data, suggests that higher incomes might not reduce child malnutrition. The data on wasting (low weight for height) also show such pattern. Number in table 4 is strictly lower than the same indicator published, for example Glewwe et al. (2002), that may rise further doubts about the informational content of these nutritional indicator. We can indicate three reasons. Firstly, these quintiles are not strictly comparable because the poorest of the Young Lives sample in 2006 had significantly different to the poorest in 1997-98 (based on Vietnam Living Standard Survey-VLSS-1997-98).

Secondly, the sampling area of Young Lives Survey is Lao Cai, Hung Yen, Da Nang, Phu Yen and Ben Tre is different strictly to that of VLSS (all provinces of Vietnam). Thirdly, the early children in this study are from 4-5 years. Malnutrition percent in this age decrease because perhaps almost children develop completely all basic domains, and overcome the most vulnerable stages of first 5 year of their life. Besides, malnutrition percent in Glewwe et al. (2002) was calculated for 0-59 month children.

Figure 5: Stunting and Wasting in Vietnam 1997-98



Source: Glewwe et al. (2002)

Table 7: Malnutrition by Number of Siblings

Number of siblings	1	≥2
Stunting	0.06%	0.33%
Wasting	0.28%	0.22%

Source: Calculated by author

Children with only 1 sibling had a proportion of low weight for height of 0.28%, as compared to 0.22 in children with more than 2 siblings. The children with number of siblings is more observable in terms of chronic malnutrition, where children with only 1 sibling are being malnourished in 0.06% of cases, versus 0.33% for children with more than 2 siblings. Those results are consistent with physiological mechanisms of malnutrition: the more children means less time for the mother to take care the index child in pregnancy that leading to prenatal stunting, and after birthing that leading to wasting. Household size is also inversely correlated with the proportion of malnutrition.

Table 8: Malnutrition by Household Size

Household size	2	3	4	5	≥5
Stunting	0.06%	0.44%	2.10%	1.55%	2.54%
Wasting	0.17%	1.38%	5.41%	2.98%	3.81%
Underweight	0.00%	0.11%	0.44%	0.28%	0.39%

Source: Calculated by author

Levels of malnutrition, especially for the height-for-age indicator, show clear relationships with the level of education of mother, going from a proportion of 3.09% of malnourished children in households where the mother has no education to 0.22% when the mother has achieved higher level after high school.

Table 9: Malnutrition by Maternal Schooling Level

	Illiterate	Primary	Secondary	High school	Others
Stunting	3.09%	1.33%	1.99%	0.06%	0.22%
Wasting	2.48%	4.20%	6.07%	0.44%	0.55%
Underweight	0.22%	0.50%	0.44%	0.00%	0.06%

Source: Calculated by author

3.3 Summary

This chapter provides an overview of health status of Vietnamese under-five children. Despite of the improvement in children health status against coutries with comparable level of income, chronic malnutrition of under-five children in Vietnam is still high according to WHO criteria. To response that problem, Vietnamese Government issue policies regarding the health of children as well as the poor in Vietnam as Program 135 (P135), the Hunger Eradication and Poverty Reduction Program (HEPR), and Program 139 (P139). These policies aimed to providing micro-credits, subsidized education, and agricultural extension services to the poor, and financing healthcare expenses for adults as well as providing free healthcare for all children under the age of 6 years. These policies will be reflected in our model as dummy variables (that equal 1 means exposure of that policy; otherwise is 0). The statistical analysis in section 3.2 verifies the positive effect of maternal education on child health. Moreover, there is a disparity in child health status among urban and rural area. The mixed relationship exists between household expenditure per capita and malnutrition. The next chapter will present the analysis of child health determinants in Vietnam.

CHAPTER 4

EMPIRICAL ANALYSIS OF CHILD HEALTH IN VIETNAM

4.1 Introduction

This chapter starts with findings of this study in section 4.2 and 4.3. The section 4.2 gives some estimates without interactive variables. The next section 4.3 present estimates with interactive variables. Finally, findings and recommendation of this study is presented in the last section 4.3.

4.2 Cross-sectional Estimates without interaction

Table 10 presents estimates of equation (5a & b), for mostly rural children, aged 4-5 years. The second column presents OLS estimates in Height-for-Age equation, as equation (5a), the third column of 2SLS estimates includes community fixed effects to control for bias due to some unobserved community variables, as equation (5b). Table 11 & 12 represent similar estimates with dependent variable Weight-for-Height, and Weight-for-Age.

Table 10: Estimates for Height-for-Age as equation (5 a & b)

	OLS	2SLS with community fixed effect
HFA	Coef.	Coef.
Age of child	-1.47 (0.05)***	-0.52 (0.04)***
Gender	0.14 (0.04)***	0.14 (0.03)***
Urban	-0.02 (0.01)*	
Ln. Expenditure per ca	0.09 (0.03)***	0.39 (0.06)***
Mother's height	0.05 (0.00)***	0.02 (0.00)***
Missing of mother's height	7.76	2.18

	(0.63)***	(0.42)***
Father's education level	0.01 (0.00)***	
Father's ethnicity	0.32 (0.12)***	0.20 (0.07)***
Mother’s ethnicity	0.31 (0.13)**	
Healthiness	0.52 (0.05)***	0.16 (0.03)***
Number of sibling	-0.12 (0.07)***	-1.86 (0.31)***
Father's age		0.00 (0.00)**
Household size		0.03 (0.01)***
Proportion of household with flush toilet within the house	0.00 (0.00)***	0.00 (0.00)*
Price of rice	-0.14 (0.04)***	
Time reach to private hospital/healthcare center	0.00 (0.00)***	-0.01 (0.00)***
Missing of time reach to private hospital/healthcare center	0.01 (0.07)	-0.01 (0.06)
Exposure to Famine Relief Program	0.22 (0.06)***	0.14 (0.05)***
Exposure to Free Health Care for Children under 6	-0.52 (0.14)***	-0.55 (0.14)***
Exposure to School Snack Program		0.14 (0.06)**
Exposure to Subsidized Government Credit	0.01 (0.00)***	0.01 (0.00)**
Exposure to Other Subsidized Credit	0.01 (0.00)***	0.00 (0.00)***
Constant	-1.49 (0.69)**	-1.28 (0.46)***

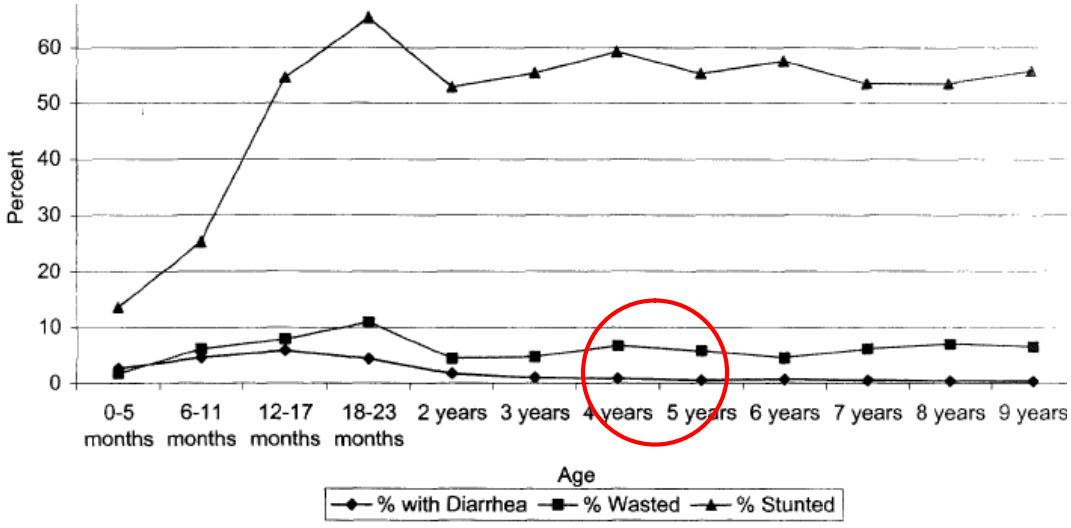
R Square	0.47	0.12

Source: Calculated by author

4.2.1 Child Characteristics

The age of child relates directly with decreases of malnutrition as measured by z-scores of height/age, weight/height, or weight/age. Although it seem to be inconsistent with previous studies, it is still reasonable. Almost previous studies use observations from 0-59 months, whereas from 4-5 years in this study. From Figure 5 & 6, malnutrition decreases from age 4-5 years because perhaps almost children develop completely all basic domains, and overcome the most vulnerable stages of first 5 year of their life. Due to different age group in the sample, the sign of estimated coefficient is still suitable with the literature.

Figure 6: Stunting and Wasting in Vietnam 1992-93



Source: Glewwe et al. (2002)

Table 11: Estimates for Weight-for-Height as equation (5 a & b)

	OLS	2SLS with community fixed effect
WFH	Coef.	Coef.
Age of child	-0.76 (0.05)***	-0.31 (0.04)***
Gender	0.17 (0.04)***	
Urban	-0.02 (0.01)**	
Ln. Expenditure per ca	0.10 (0.02)***	
Mother's height	0.03 (0.00)***	0.01 (0.00)***
Missing of mother's height	4.95 (0.55)***	1.88 (0.45)***
Father's education level	0.00 (0.00)*	
Healthiness	0.72 (0.04)***	0.29 (0.04)***
Time reach to public hospital		-0.01 (0.00)***
Missing of time reach to public hospital		0.14 (0.08)
Proportion of household with flush toilet within the house	0.01 (0.00)***	0.01 (0.00)***
Exposure to Free Health Care for Children under 6	-0.33 (0.11)***	-0.69 (0.17)***
Exposure to School Snack Program	0.24 (0.05)***	0.52 (0.08)***
Exposure to Famine Relief Program		0.12 (0.08)**
Exposure to Resettlement and Sedentarization		-0.27 (0.08)***
Exposure to Subsidized Government Credit	0.00 (0.00)*	0.27 (0.08)***
Exposure to Other Subsidized Credit	0.00 (0.00)***	
Constant	-2.64 (0.56)***	-0.87 (0.49)

R Square	0.34	0.222

Source: Calculated by author

Child's gender associates with chronic malnutrition but not acute one, the estimated coefficients of this variable is not statistically significant in table 11 & 12. In Vietnam, there is not evidence of parental preferences leading to gender discrimination for child nutrition and feeding. The significant coefficient in table 10 indicates girls typically are healthier than boys in Young Lives Survey.

Maternal height: The work of Glewwe et al. (2002) indicates that parent's height is strongly and positively related to child health. This variable controls for unobserved prenatal endowment linked to genetic factors; it thus shows natural variations in height across healthy population. The maternal stature positively associates with three z-scores indicators. However, the average maternal height is 151.9 centimeters, which is certainly the same than the national Vietnamese average.

Table 12: Estimates for Weight-for-Age as equation (5 a & b)

	OLS	2SLS with community fixed effect
WFA	Coef.	Coef.
Age of child	-0.76 (0.05)***	-0.20 (0.03)***
Gender	0.17 (0.04)***	
Urban	-0.02 (0.01)**	
Ln. Expenditure per ca	0.10 (0.02)***	
Mother's height	0.03 (0.00)***	0.01 (0.00)***
Missing of mother's height	4.95 (0.55)***	1.24 (0.30)***
Father's education level	0.00 (0.00)*	
Healthiness	0.72 (0.04)***	0.19 (0.02)***
Time reach to public hospital		0.00 (0.00)***

Missing of time reach to public hospital		0.09 (0.05)*
Proportion of household with flush toilet within the house	0.01 (0.00)***	0.00 (0.00)***
Exposure to Free Health Care for Children under 6	-0.33 (0.11)***	-0.46 (0.12)***
Exposure to School Snack Program	0.24 (0.05)***	0.34 (0.05)***
Exposure to Famine Relief Program		0.08 (0.04)**
Exposure to Subsidized Government Credit	0.00 (0.00)*	
Exposure to Other Subsidized Credit	0.00 (0.00)**	
Constant	-2.64 (0.56)***	-0.54 (0.12)
R Square	0.34	0.22

Source: Calculated by author

4.2.3 Household Characteristics

Father's ethnicity keeps an important role in parental decisions relating with child's health status. Teerawichitchainan and Phillips (2008) find out parent of ethnicity minority children are less likely to report that their children were sick. When they recognized illness epos ides, they were likely to seek care. This finding remained in remote areas and at all income level.

The age and education level of parents, as well as **their age difference** were the variables chosen to enter the regression. The age of parents and the age difference of parents are associated with short-term child's health indicators (Table 11 & 12). Therefore, a allocate decisions of household's resources (food) are equally reserved by parents. However, the age of father associates with Height-for-age Z-score. Thus, the father has more power to make long-term decision due to his contribution to household income.

Education level of father is a proxy variable to see the impact of fathers education on the child's health. The work of Mosley and Chen (1984) indicate that education level of

father usually is associated strongly with occupation, consequently with family income. With household income (proxy variable as natural logarithm of expenditure per capita) is included in the regression, the income effect of father's education level is controlled. Thus, estimated coefficient of this variable is statistically insignificant in table 10-12. Although mothers usually play an important role concerning the child's nutrition and health status; it is surprising that **mother's education level** is not significant statistically.

The number of sibling has a negative relationship with child's health status (-1.86 in HFA equation). The problem for larger families with more children that is these families need to allocate limited available resources across more consumers. Children compete for limited parental care and resources – a notion commonly labeled as 'sibling rivalry' in economics. The greater the number of children living in a household, especially in areas with large percentages of poverty, the more likely is children going to suffer some kind of malnutrition.

4.2.4 Income Variable.

This study uses the natural logarithm of annual household expenditures per capita as proxy for full household income. Instrumental variables (non-labor income and land area) are used to control for the remaining potential endogeneity of the proxy variable. The estimates suggest that this variable has a clear positive impact in reducing child's chronic malnutrition (coefficient in height-for-age equation: 0.39): it is important to mention that this sample comes from a region characterized as poor and rural, where increases in household income will definitely improve the family living standards and consequently the child's health. Conversely, the impact on the WFH and WFA variables are not significant. Since WFH and WFA associates strongly with current income but weakly with permanent income, whereas natural logarithm of annual household expenditures per capita is a proxy for permanent income. Moreover, this reason leads to negative sign of this coefficient in table 14 & 15.

4.2.5 Community variables

The proportion of households with flush toilet within the house is 32% of the sample, and this variable positively correlates short-term malnutrition as well as long-term one.

The second community variable group is time to reach a public hospital, private hospital/clinic; the corresponding average time of this variable is 15 & 16 minutes respectively, with a large standard deviation. The coefficients of these variables are significant, suggesting that travel distance to the health facilities play a role in defining the nutritional status of the child.

The third variable group is represents the intensity of government program direct-interventions to poor families with mothers and children. The coefficient of these variables (free health care for children under 6, school snack program, famine relief program, resettlement and sedentarization, subsidized government credit, other subsidized credit) are significant at the community level. It is strictly accepted among policy makers that programs like this one have a high impact in reducing child malnutrition in poor communities.

The fourth variable group is price of rice (this cereal is widely consumed on an everyday basis in the region) and price of milk (this basic input is more directly related to child health and nutrition). The coefficient estimates for two kind of price variable are not statistically significant, this could be explained by the fact that rice is consumed by everyone, even when cash is scarce, since rice is produced by most families and the price becomes only relevant when families have no cash or food at all. For milk, due to consumption behavior of Vietnamese (especially in rural areas) and its high price, milk still is not popular as supplement food for children.

4.3 Cross-Sectional Estimates with Variables interaction

This section discusses the estimated coefficients of regression equation (7b), as presented in Table 13-15. The second column presents 2SLS estimates with community fixed effect, the third column includes more interactive variables. When interactions are allowed into the model, with community fixed effects, the estimated coefficients for the child variables remain virtually the same. **Household per capita expenditures** become robust estimates in all regressions, as interactions and community fixed effects do affect this estimator in case of WFH and WFA (Table 14 & 15). The reason leads to negative sign of this coefficient in table 14 & 15 mentioned above. This problem met in previous studies (Alves and Belluzo, 2004). The coefficient still is positive and highly significant

in the height-for-age equation. In the weight-for-height equation it was not significant. This result indicates that stunting is positively associated with poverty. Higher per capita income leads to better health, as reviewed in theoretical framework.

Table 13: Estimates for Height-for-Age as equation (5b & 7b)

	2SLS with community fixed effect	2SLS with community fixed effect and interactive variables
HFA	Coef.	Coef.
Age of child	-0.52 (0.04)***	-0.57 (0.03)***
Gender	0.14 (0.03)***	0.06 (0.03)**
Urban		0.00 (0.00)***
Ln. Expenditure per ca	0.39 (0.06)***	0.34 (0.07)***
Mother's height	0.02 (0.00)***	0.02 (0.00)***
Missing of mother's height	2.18 (0.42)***	2.79 (0.41)***
Mother’s education level		-0.02 (0.01)*
Father's education level		0.00 (0.00)**
Father's ethnicity	0.20 (0.07)***	0.18 (0.07)***
Healthiness	0.16 (0.03)***	0.21 (0.03)***
Number of sibling	-1.86 (0.31)***	-0.14 (0.05)***
Father's age	0.00 (0.00)**	
Household size	0.03 (0.01)***	
Proportion of household with flush toilet within the house	0.00 (0.00)*	0.00 (0.00)*
Time reach to private hospital/healthcare center	-0.01	-0.01

	(0.00)***	(0.00)***
Missing of time reach to private hospital/healthcare center	-0.01 (0.06)	-0.05 (0.05)
Exposure to Famine Relief Program	0.14 (0.05)***	0.12 (0.05)***
Exposure to School Snack Program	0.14 (0.06)**	
Exposure to Free Health Care for Children under 6	-0.55 (0.14)***	-0.60 (0.16)***
Exposure to Subsidized Government Credit	0.01 (0.00)**	0.00 (0.00)***
Exposure to Other Subsidized Credit	0.00 (0.00)***	0.00 (0.00)***
Mother's education level & School Snack Program		0.01 (0.01)**
Mother's education level & Free Health Care for Children under 6		0.01 (0.01)
Constant	-1.28 (0.46)***	-1.15 (0.45)***
R Square	0.12	0.31

Source: Calculated by author

However, the mother's education level becomes a much more significant factor in all three dimensions of nutritional status. The negative sign of coefficient reflect opportunity cost of time of maternal schooling. In transitional economy like Vietnam, women often participates the labor market and contributes important part to household income. Moreover, there is significant, generally positive, interaction between this variable and intervention program variables (school snack program, and free health care for children under 6). Thus it would seem that the overall level of development/capacity of the community would tend to equalize/hide the individual role of educated adults in the households, this role becoming more apparent when taking into account this interaction. The positive value observed for the interaction variable may thus indicate that exposure to such programs could complement for mother's education. Although mean of mother's schooling level is approximately 7, it is quietly higher than average level in countries with comparable level of income. More educated mother might be

more likely to take advantage of local clinics and nutrition programs; they may be more likely to adopt sanitary, nutrition or health practices which are conducive to child growth. Therefore, these health and nutrition programs will complement the effect of maternal education on child health.

Table 14: Estimates for Weight-for-Height as equation (5b & 7b)

	2SLS with community fixed effect	2SLS with community fixed effect and interactive variables
WFH	Coef.	Coef.
Age of child	-0.31 (0.04)***	-0.31 (0.04)***
Gender		0.06 (0.03)**
Urban		
Ln. Expenditure per ca		-0.03 (0.07)
Mother's height	0.01 (0.00)***	0.01 (0.00)***
Missing of mother's height	1.88 (0.45)***	1.98 (0.47)***
Mother’s education level		-0.03 (0.02)*
Healthiness	0.29 (0.04)***	0.29 (0.04)***
Time reach to public hospital	-0.01 (0.00)***	0.00 (0.00)***
Missing of time reach to public hospital	0.14 (0.08)	0.17 (0.06)***
Proportion of household with flush toilet within the house	0.01 (0.00)***	0.01 (0.00)***
Exposure to Free Health Care for Children under 6	-0.69 (0.17)***	-0.78 (0.23)***
Exposure to School Snack Program	0.52 (0.08)***	0.37 (0.12)***
Exposure to Famine Relief Program	0.12 (0.08)**	0.15 (0.06)***
Exposure to Resettlement and Sedentarization	-0.27 (0.08)***	

Exposure to Subsidized Government Credit	0.27 (0.08)***	
Exposure to Other Subsidized Credit		
Mother's education level & School Snack Program		0.03 (0.01)**
Mother's education level & Free Health Care for Children under 6		0.03 (0.02)*
Constant	-0.87 (0.49)	-0.98 (0.53)*
R Square	0.222	0.23

Source: Calculated by author

Table 15: Estimates for Weight-for-Age as equation (5b & 7b)

	2SLS with community fixed effect	2SLS with community fixed effect and interactive variables
WFA	Coef.	Coef.
Age of child	-0.20 (0.03)***	-0.20 (0.03)***
Ln. Expenditure per ca		-0.14 (0.06)***
Mother's height	0.01 (0.00)***	0.01 (0.00)***
Missing of mother's height	1.24 (0.30)***	1.39 (0.31)***
Mother's education level		-0.04 (0.01)***
Father's ethnicity		0.14 (0.05)***
Healthiness	0.19 (0.02)***	0.18 (0.02)***
Household size		-0.02 (0.01)*
Time reach to public hospital	0.00 (0.00)***	
Missing of time reach to public hospital	0.09 (0.05)*	

Proportion of household with flush toilet within the house	0.00 (0.00)***	0.01 (0.00)***
Exposure to Free Health Care for Children under 6	-0.46 (0.12)***	-0.82 (0.13)***
Exposure to School Snack Program	0.34 (0.05)***	
Exposure to Famine Relief Program	0.08 (0.04)**	0.09 (0.04)**
Mother's education level & School Snack Program		0.04 (0.01)***
Mother's education level & Free Health Care for Children under 6		0.04 (0.01)***
Constant	-0.54 (0.12)	-0.02 (0.34)
R Square	0.22	0.194

Source: Calculated by author

4.4 Conclusions and Recommendations

A traditional view of the factors influencing child health and nutrition opposes household-level variables (or private determinants), such as parental education and household income, to community-level variables (or public interventions), such as community infrastructure, access to health services. Household-level variable is often used to reflect individual efforts and achievements. In this study, we hope construct a maybe more useful model to look at other dimensions of possible determinants/interventions in long-term as well as short-term.

From an operational point of view and from the results obtained here, it seems clear that individual and household-level factors are still the main determinants of child health, as assessed through those three indicators of nutritional status. Maternal biological endowments, measured through maternal height, are the key variable, susceptible to short-term interventions such as maternal nutrition and care during pregnancy, but also likely to improve over generations through the cumulative impact of all other interventions.

Household income comes second in relative importance: while its overall determinants may be the status of the national economy and the employment opportunities, its impact also depends on the size of the family, that is, the number of people who have to leave from this income, leading to long-term population and family planning policies. Number of sibling is identified as critical factors for the child's growth.

Education levels of mother not significantly related to any of the nutritional status indicators. However, it is nullified by the inclusion of interaction variables. As the sign of the interaction variables' coefficients are mostly positive, the interpretation is that individual deviances in education level are complemented by intervention programs.

Few of the community-levels variables are individually significant, for example the proportion of household with flush toilet within the house reflects the progress of sanitary infrastructure. Direct health/nutrition interventions seem to have large impact on the child's nutritional status. Indeed, when those variables take a statistically significant value.

Using the (community) fixed effect model allows to better qualify the intra-community variations in individual and household variables, independently of the impact of inter-community variability. The inclusion of community fixed effects in the model does not drastically change the parameters of the other variables.

Therefore, the findings of this study would point out at the need to improve intra-community (household and individual) targeting rather than inter-community targeting, as the former parameters seem to have a major role as determinants in child health and nutrition. The trilogy of improved socioeconomic situation, sound population and family planning policies and appropriate preventive public health care (maternal nutrition, hygiene and child feeding practices) are still a safe – although longer term - investment towards improved health and productivity of today's children.

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