Effects of Early Life Nutrition and Poverty on School Attendance and Completed Schooling of the Vietnamese Adolescents

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Significant research in the developing countries discussed negative effects of malnutrition in childhood on school enrollment and outcomes. The most controversial conclusions focus on the causation that poor nutrition in the childhood, especially in the first two yeas of life would lead to delay in primary school enrollment, to repeat grade, to have larger negative cognitive development, and school outcomes (Glewwe et al. 1995, Glewwe et al. 2001, Daniels and Adair 2004). With the given early life disadvantages, how far a child who had had malnutrition would attend school has not been discussed. The major obstacle was that there was no available longitudinal data with childhood nutrition status and educational attainment in the developing countries.

This paper discusses the effects of middle childhood nutrition status and level of household poverty on school attendance and completed schooling using individual-based sub-sample of 1,517 children aged 15 to 17 in 1998 from the Viet Nam Living Standard Surveys of 1992-93 and 1997-98. Results from multivariate analysis reconfirm that parental education still remains as the most important determinants of school attendance and completed schooling. The level of household poverty at the present time is another significant factor determining schooling attendance and outcomes. Stunting at the middle childhood had significant effects on probability of school attendance and achievement. However, these effects lose statistically significance when the household poverty level is controlled in the model.

Introduction

Early childhood conditions have long lasting effects on the adulthood achievement in education and ability-related outcomes (Duncan et al. 1998, Glewwe at al. 2001, Daniel and Adair 2004). Since the rate of stunting is highly correlated with the level household poverty, understanding the relationship between stunting and poverty on the development of child's cognitive skills and their achievement in the adulthood is a key important of the public policy application to break the cycle of poverty.

Due to lack of the longitudinal data on childhood nutrition and educational attainment after the age of 20, the discussion of this topic has been limited to the inequality in primary school enrollment and children cognitive skills measured by the math and IQ tests. As several longitudinal data sets with information about childhood condition become available recently, such as the Boyd-Orr cohort in the United Kingdom and the CEBU data in the Philippines, the issues of childhood nutrition and poverty condition are increasingly discussed as very important factors in adult wellbeing and achievement.

Poverty in the childhood significantly affected children's development. However, there is a little known to what extent poverty affects children's development in the childhood and thereby reduces their ability in education and other ability-related outcomes in the adult life in the developing countries. The poverty rate had declined rapidly in Viet Nam shortly after the country implemented the political and economic reform in 1986. In the 1990s, the poverty rate reduced from 58% in 1993 to 37% in 1998 (GSO, 2000). Similar to other countries, child malnutrition in Vietnam is also highly

correlated with the level of poverty. In the 5-year period, the height for age among children below the age of 18 declined from 44% in 1993 to 41.5% in 1998.

In social-demography and sociology, the impact of parental SES and household condition on children's life is a controversial research question across all societies. In economics and nutrition sciences, strong research literatures discuss the association between malnutrition, especially stunting, on low educational test scores and educational achievement. Using the longitudinal approach, Duncan et al. (1998) reported that family conditions in early childhood have the greatest impact on the likelihood of school completion, especially among children in families with low incomes. Similarly, early childhood nutrition status also had strongest effects on age of school enrollment, and academic progression (Glewwe and Hanan, 1995).

Many of the work to date using household survey data estimates the consequences of household poverty and other socioeconomic factors of the current time on educational attainment. Significant other studies examined effects of early childhood nutrition on school enrollment and cognitive skills. In this paper, I attempt to analyze effects of the middle life condition on adolescent's school attendance and completed schooling for children in the ages of 15 to 17 which have not been discussed in the past studies using the longitudinal aspects of the data. Due to the availability of the data, the early life condition are examined using household's expenditures and poverty status and child nutrition status measured by height for age z-scores of the previous 5 years. There is significant proportion of the children who have not completed their education at the time of the surveys. Therefore, I use the ordered probit regression with censoring to control for this data problem. This research is conducted using both middle childhood z-scores and

the household income levels at the current time of 1998 and the previous five years. During this time period, Vietnam had experienced rapid changes in socioeconomic development and reduction in poverty. This analysis also plan to measure and discuss the correlation between middle childhood child stunting and poverty, and its effects on the children's educational attainment.

Background

Poverty and educational achievement

The standard status attainment model which incorporated parental SES, parental income to predict educational attainment and early labor market outcomes often reports significant effects of parental SES and household income. Smith et al. (1997) examine the impacts of family income in the early childhood and at the time of the cognitive skill tests on children's ability-related outcomes. The authors conclude that children of the extremely poor families which were defined as less than one-half of the poverty line had significantly lower scores on various standardized tests compared to children of the highest income group. The effects of poverty on children's cognitive skills are not always statistically significant for the group of household income within the range from just below the poverty line. The explanations for income effects on children's achievement focus on differences in home environment between the high and low income households (Smith et al. 1997) and the effects of economic pressures on children's self-confidence and achievement in the low income families (Conger at al. 1993). Adding middle childhood family income variable in the regression model, Duncan et al. (1998) report that income in the early childhood had stronger impacts on high school completion than

the effects of the middle childhood household income. Increase in family income would have greater effects for children's educational attainment in the very low income households than the other income groups.

Nutrition status, cognitive development and educational outcomes

There is increasingly evident that the first two years of childhood nutrition has long-lasting effects on children's brain growth and cognitive function of children (Gale et al. 2003, Wilson et al. 1986). Gale et al. (2003: 328) report that brain growth during the infancy and early childhood highly determines children's cognitive development measured by the intelligence quotient (IQ). The authors also conclude that the critical period for head growth and cognitive development is from the time of birth to the age of 9. Therefore, infancy and early childhood nutrition play important roles in education and ability-related outcomes in the adult life.

There are substantial effects of parental SES and family income on early childhood nutrition status (Dubois and Girad, 2003). Based on the fact that child malnutrition rates are significantly high in the developing countries, the relationship between consequences of chronic childhood malnutrition measured by stunting on cognitive function has been a topic of interests of many researchers. A negative correlation between chronic under-nutrition and educational outcomes reports in the randomized trial conducted in Viet Nam in 1999 (Partnership for Child Development, 2001). Another clinical study conducted in Guatemala presents similar results (Li et al. 2003). The authours' conclusion is clearly states that better nutrition during early

childhood would significantly increase educational achievement in the adulthood under the condition that the individuals completed the transition to complete primary education.

Using Peruvian longitudinal household data Berkman et al. (2002: 569) estimate stunting in the second year of life would lead to 10-point lower in IQ scores holding the socioeconomic, schooling, and other factors at constant. This finding is very similar to the result of a study using the Cebu longitudinal data for the Filipino population by Mendez and Adair (1999). Regarding to the timing effect of the childhood malnutrition, Glewee and King (2001) report that nutrition status in the period from 18 months to 24 months tend to have larger negative effects than the first year of life on the later cognitive development and educational outcomes for Filipino children. The authors do not find the evidence to support the claim that nutrition status in the first six months of life are the most critical period to determine cognitive development.

Detailed examinations of the relationship between childhood malnutrition and school performance and outcomes using the Filipino data report strong direct effects of height for age on test score (Glewwe et al. 2001). The authors estimate that children's test score would increase by 19.6 points when children's height increase one standard deviation. Besides the direct effect, height for age also has indirect impacts on educational achievement through its effects on age of school enrollment and school progression. One standard deviation increase in height for age would reduce two months of late school enrollment at the first grade and reduce the probability of repetition the first grade by 9%. Other study by Daniels and Adair (2004) report that the age of school enrollment and IQ are two mediators in the causal model between nutrition and education with the adjustment of other factors, such as parental education, maternal height,

household assets and income. In this research, taller children tend to enter school at the minimum age of the primary school and follow normal grade progressions. Similarly, the probabilities of grade repetition and school drop out are significantly lower among the taller group than those who are stunted (Daniels and Adair 2004).

Nutrition status, poverty and educational achievement

A study of the effects of nutrition, health, and SES on the cognitive development by Wilson et al. (1986) reported that increase in height for age z-scores has significant positive effects on IQ test score at both early and middle schooling ages. When the model is controlled for income, race, and family size, the effect of height for age still remains its statistically significant. In this model, family income is also important predictor for schooling outcomes. When family income is included in the model, children's nutritional status do not have consistently negative effects on cognitive function. Ivanovic et al. (2004) report that SES of parents, home environment, and head circumference for age z-scores have statistically significant effects on scholastic achievement of children in Chile metropolitan regions. Other anthropometric measurements do not have significant correlations with scholastic achievement and intellectual ability when individual characteristics and family factors are included in the regression model (Ivanovic et al. 2004: 883-884).

Methodology and Research Questions

The relationship between poverty and educational outcomes or between nutrition status and educational enrollment, progression, and cognitive development in the

developing countries has been of interest of many researchers. Examinations the effects of multi-factors, such as nutrition, household income, and poverty and school enrollment, progression, on cognitive skill development have also discussed. Nevertheless, the mechanisms by which early and middle childhood poverty and nutrition influence the completed schooling have not been discussed. This paper examines effects of poverty in middle childhood on educational attainment. I focus on the group of extremely poor whose their household expenditure per capita was below one-half of the poverty line in the previous five-year period. I include the middle childhood and the current height for age z-scores in the multivariate model to predict educational attainment, controlling for household poverty at two time periods.

Based on empirical findings in other developing countries and the condition of economic transition in Viet Nam, my main research questions are 1) how much the household poverty during the early life period affects educational outcomes of children? 2) to what degree the nutrition factors contributes to educational inequality of children aged 15 to 17, controlling for the household condition in the past and at the present time? 3) how much parental SES contributes to children's educational attainment?

The analysis is based on the traditional model of social inequality examines effects of household and individual factors in educational attainment (Duncan 1967, Shavit and Blossfeld eds. 1993). Aside from persistent inequality in parental SES, gender and regional disparities are two major barriers to school enrollment in developing countries. This model also includes nutrition status variables at the current time and the 5 years in the past to examine direct and indirect effects of middle childhood poverty on educational attainment.

The research questions are addressed using logistic regression predicting the probability of remaining in school for the age group of 15 to 17 years old. For the dependent variable as years of school completed, the traditional educational attainment model often uses a simple OLS regression with the condition that all individuals in the sample already completed a given level of education. For this sample with a large proportion of children in school, the model of educational attainment can be estimated using censored probit regressions with a variable censoring indicating person still in school.

Data

I use data from two round of the Vietnam Living Standard Survey of 1992-93 and 1997-98 (VNLSS). The VNLSS data sets contain a rich source of micro-level information for social research in four main broad fields: 1) data on households, 2) data on rural communities and small towns, 3) data on schools and community health centers for all rural communities and small towns, and 4) data on prices for all communes and wards in the sample. This survey had a longitudinal design, with a baseline survey conducted in 1992-93. The second survey in 1997-98 was a cross-sectional survey with a part of longitudinal sample from the 1992-93 (Table 1). Due to the fact that school and community surveys were only collected in small town and rural areas, this paper does not incorporate any community level variables in the analysis.

[Table 1 about here]

The household data set of VNLSS contained information on the basic socioeconomic and demographic characteristics of households across regions and geographic areas. The sampling design was a three-stage cluster sampling based on information from the Vietnam Census of 1989. The VNLSS of 1992-93 has a sample of 4,800 households in 150 communes. These household were selected from a population of approximately 10,000 communes with an average of 6,500 people in each commune. As a nationally representative sample, the survey design took into account the urban-rural differences where 20 percent or 60 sampled residential blocks are in urban areas (Table 1).

The second round of the survey was implemented in 1997-98. In this round, the sample size was increased to 6,000 households from 4,800 households in the 1992-93 survey. The sample size for the second survey was adjusted to the national representative sample to 6,000 households including 4,704 households comprising panel data of re-interviewed households from the first round (Table 1). An additional 1,290 new households were interviewed in order to make a nationally representative sample of the population at the time of the second survey.

The VNLSS collected information on individual characteristics and anthropometric data, education, parental socioeconomic status (SES), and household income and expenditures for all members of the surveyed households. The individual-based sample for this paper includes 1,517 children aged 15 to 17 in the survey of 1998 who was interviewed in the survey of 1992-93. The distribution of the data and variables in the analysis is displayed in Appendix 1. There were, however, substantial changes in the questionnaire design of the second survey, particularly in the educational section. The

follow-up survey had a new section on repetition, year of entry to school, and grade points average at the end of the last academic year for all children who were in school. Furthermore, it asked more details on educational attainment by year of completion, degree obtained, and specific categories of educational expenditures. In addition, simple tests of reading comprehension and mathematics were conducted for children at the primary education level.

Variables

Dependent variable was years of schooling for all children at the ages of 15 to 17. This variable includes all persons who have never been to school, were still in school, and already quitted schooling. Due to the fact that 54% of the sample was still in school, this variable was treated as a censored variable in the ordered probit regression (Table 2). In order to eliminate the right censored problem of the educational attainment variable, I used the main dependent variable and a censored variable. This new variable was constructed as a dummy variable where value "1" indicates censored values for those who were still in school in 1997-98.

[Table 2 about here]

Two set of key independent variables in this papers were the nutrition status and household expenditures and poverty status. In these samples, most of children had the measurement of heights and ages in two rounds of the data collection. Among all measurements of child nutrition, low height for age reflected the long lasting effects of

early childhood malnutrition on children's development (Alderman at al. 2003). Height for age z-scores for the children sample aged 15 to 17 in 1997-98 and 5 years earlier were calculated based on the CDC/WHO 1978 reference. The height and age z-scores indicated a standardizing comparison of child's height at the given age and gender using the international reference population. Similar to the WHO standard, children who have z-scores less than -2 were considered as stunting in this analysis. The sample of 1992-93 collected 98% height measurements for children in the age group of 10-12 years old. Roughly, two-thirds of the children were stunted in 1993. On average, height for age z-score was at 2.27 standard deviation below the median child in a given age/sex group (Appendix 1). The follow-up survey collected only 84% height measurements of those who were measured in the baseline survey in the same birth cohort. Therefore, missing values in the height for age variables are coded at the mean of the height for age z-scores in the multivariate analysis. After five years, children's heights were slightly improved. The average height for age z-score has reduced to -2.11. Stunting rate reduced by 9 percentage points to 53% of all children aged 15-17.

The household expenditure variable was adjusted by the household size and inflation in the five-year period. The poverty line in Vietnam was defined at 1,160 million VND in 1992-93, and at 1,789 million VND in 1997-98 for all household expenditures. In the five year period, the proportion of households under the poverty line was reduced rapidly from 58% to 34% (GSO, 2000). I defined four broad category of households based on their level of expenditures: 1) below half of the poverty line; 2) in the rage from a half below to the poverty level; 3) from the poverty line to 1.5 times above the poverty line; 4) above 1.5 times of the poverty line. The highest level of

household expenditure was a reference category in the multi regression analysis. As the poverty rate was relatively high in Viet Nam in the early reform period and reduced significantly after 5 years, this paper focuses on examining the effects of poverty in the mid-childhood on the educational outcomes later.

I included in the model predicting completed schooling a set of parental SES, individual characteristics, and geographic location. Parental SES had strong effects to keep their children in school (Shavit and Blossefed, 1993, Filmer, 1999). In this paper, parental SES included father and mother level of education from no education to high school and higher level of education and their occupation in four broad categories of professional jobs, sale and service, blue colar, and agriculture.

Besides parental SES, gender, ethnicity, place of residence in urban-rural and seven main regions in Viet Nam were included in the model in order to access hypothesis regarding that might account for or mediate the relationship between early nutrition status and poverty conditions and children's educational outcomes. Female disadvantage in educational enrollment and attainment varied across regions in developing countries (Filmer, 1999). Family financial resource was a major source of inequality in school enrollment. The gender gap was found to be serious in the countries where the wealth gap is large (Filmer, 1999). Controlling for school conditions, a study in China by Brown and Park (2002: 538) also confirmed compounding effects of poverty and gender on educational opportunities. Girls who perform poorly in school likely drop out from primary school while boys did not begin to drop out until junior high school. Lack of available funding in poor household was the major reason for not enrolling school

(Brown and Park, 2002). Geographic disparity was found to have impacts on student's enrollment and achievement (Hanum, 2003; Ram, 1995).

Results

Description of Educational Status

Table 2 presents summary statistics of children's education in the two time periods by nutrition status, gender, and place of residence. On school enrollment status, majority of children enrolled in school in the last 5 years (Table 2). By the ages of 15 to 17, the rate of school enrollment reduced significantly to just 54% of children in the same age group. It is expected that school enrollment is in advantage of better nourished children, boys, and urban residents. In fact, the VNLSS data only reported a significant and persistent large gap in school enrollment and progression between the rural and urban areas in all indicators of school enrollment status. That is, the rate of school enrollment was about 23 percentage points higher in the urban areas than those who lived in the rural areas. Gender gap was narrowed down in school enrollment in the five-year period. Children's nutrition status had a modest gap in school enrollment in 1993; however, it did not seem to make a significant difference five years later.

About 45 percent of children delayed school enrollment at the first grade at the minimum age of 6. Delaying school enrollment was more common due to the effects of nutrition and place of residence than the gender differences between girls and boys. A large proportion of children who lived in rural areas did not enroll in the first grade at the minimum age of 6 (Table 2). Similarly, late school enrollment was also more common

among the stunting children than the normal group. Perhaps, children's physical and health condition were the key issues for determining the age of starting school.

Regarding to schooling progression, the rate of repetition was similar to the patterns of the other developing countries where repetition rate was high at the primary level and reduced rapidly at the secondary level due to the effects of selection. Children who were stunting and/or living in rural areas had higher rate of repetition at the primary school level. At the secondary levels, the rate of repetition was not much different for those groups. There was a significant treatment in favor of boys in schooling, especially at the secondary education. The rate of repetition was higher among the boys than the girls.

Poverty, Nutrition Status, and School Enrollment

This section explores correlations across poverty level, nutrition, and educational enrollment. Table 3 presents frequencies and zero-ordered correlation between the level of household expenditures in 1993 and 1998. The correlation between household poverty level in 1993 and 1998 was at .61. Overall, there were rooms for the upward movement of the poor households (Table 3). It was significant improvement in living standards of the households with the level of expenditures below the poverty lines. Only 14 percent of the household with total family expenditures below a half of the poverty line in 1992 still remained in the same poverty group. Two-thirds of the household in this expenditure category had increased their level of expenditures to one level higher which was a half below of the poverty line.

[Tables 3 and 4 about here]

Distributions of children nutrition and school status by the level of poverty display in Table 4. In general, the results followed the fact that the rate of school enrollment was high for the high level of household expenditure groups and reduced rapidly with the decline in the level of household expenditures. The gap between the rich and the poor in school enrollment was smaller when the children at the younger ages. At the age of 15 and older, the rich and poor gap increased sharply. Only 17% of children from the household expenditures below a half of the poverty line attended school. In contrast, 79% of the children in the top expenditure group still enrolled. Furthermore, there were also high rate of school drop out and illiterate among the poorest group.

Table 4 also reported that the poor household had higher rate of stunting. Unlike the gap in school enrollment, the gap between the rich and the poor in stunting was fairly stable over the five-year period. Increase in living standards did not significantly reduce the rate of stunting in all expenditure groups.

On the correlation of household poverty levels in 1993 and 1998 with educational status and year of schooling, it is clear that recent poverty level had higher correlation with educational variables than the household poverty level in the past five years (Table 5). This correlation was similar when controlling for gender, nutrition status, and place of residence. The correlation of household expenditures and schooling was higher in the girls' group than the boys'. In addition, the correlation between poverty and educational enrollment was somewhat higher in the stunting group compared to the normal group in 1998. However, the pattern was not persistent for the stunting group in 1993.

Multivariate Analysis of School Attendance and Achievement

Effects of parental SES, nutrition status, and poverty level on educational enrollment present in Table 6. This table displays odds ratios for the logistic regressions on the determinants of school enrollment under given individual characteristics, nutrition status, parental SES, and household economic condition. There are 6 models to predict effects of four main sets of coefficients measuring the degree to what each set of the covariates contributes to the likelihood of school enrollment for children aged 15 to 17.

[Table 6 about here]

The first model predicts the probability of remaining in school by children's height for age z-scores at the time of 1998 and the five year earlier. The first row indicates that one standard deviation increased in height for age z-scores in 1993 would increase the odds ratio of school enrollment to 1.27 times. The model also reports that height for age of in the past five year had significant effects on the likelihood of school enrollment at the current time. However, height for age at the time current school enrollment does not increase the probability of school attendance.

Model 2 presents a test on the effects of the level of household poverty on educational enrollment. Results from this model report that the current level of household poverty strongly determines the likelihood of school enrollment for the children in the age group of 15 to 17 years old. As the household living standards had increased substantially in the past five year, the level of household expenditure in the past five years does not have significant coefficients, except for the lowest expenditure group. The children of the households with their total expenditures below a half of the poverty line in

1998 had the lowest probability of school enrollment compared to the highest expenditure group. The odds of attending school increase gradually as the level of the household expenditures getting higher. The odds of school attendance of the 2nd group of expenditures in 1998 are still substantial low compared to the top expenditure group.

Model 3 examines effects of individual characteristics and place of residence on the probability of school attendance. In this model, girls tend to have higher probability of not attending school than the boys of this age group. Place of residence in urban has the strongest effects on the likelihood of schooling, net of all other factors. It is also expected that children living in the Mekong River Delta region are less likely to attend school (citation).

Across four main sets of covariate models, parental SES model has strongest effects on determinants of school attendance (Model 4). In more specific, father and mother education strongly predict school attendance of children. Odds of school attendance would increase sharply for children who either a father or mother has upper secondary education and higher. Although father's education tends to have stronger effects on children's schooling than the mother's education, mother occupation in professional and management positions tends to have the highest effects on the probability of school enrollment of her children. A professional mother would increase the odds of school attendance to 8.8 times compared to the agricultural job, controlling for the model of father' and mother's SES.

With individual characteristics and nutrition status in Model 5, height for age covariate loses statistically significance on school attendance (Model 5). However, the level of household poverty still significantly influences the probability of school

attendance. Results from Models 5 and 6 do not support for the hypothesis that the middle childhood nutrition status has significant effects on the present schooling achievement. These models, however, confirm the traditional attainment model that parental SES, especially education, is the most affluence determinants of school attendance. The level of household poverty at the present time is also has significant effects on children's schooling.

Table 7 presents coefficients for the models estimating years of schooling completed. Due to the fact that the distribution of the dependent variable is in the discrete order and has right censoring values, I use the ordered probit regression controlling for censored values in this section. The estimations in Table 7 follow similar setting of the above models to predict school attendance.

[Table 7 about here]

Regression results in Table 7 are very similar to the outcomes in Table 6. That is, parental education always has statistically significance in predicting completed schooling. Similar to the estimates in Table 6, height for age z-scores in 1993 and 1998 are not significant in the full model when the level of household poverty are controlled (Model 6, Table 7). Thus, there is no evidence to support for the claim that stunting in middle childhood has significant negative effects on years of schooling completed. In fact, the highly negative significant coefficients of the level of household poverty suggest that these covariates strongly determine educational attainment.

Conclusions

The analyses reconfirm the traditional educational attainment model on the persistent importance of parental SES in predicting educational attainment of the offspring (Shavit and Blossfed eds. 1993). In Viet Nam specific condition, having parents with at least secondary education is an absolute advantage for young children to remain in school and complete high school. In addition, I find a strong link between level of household poverty on determinants of school attendance and completed schooling among children aged 15 to 17. This finding is consistent with the finding by Duncan et al. (1998) in their analysis using the longitudinal data from the United States. The attempt to link nutrition status, especially middle childhood nutrition condition, with the probability of school enrollment and attainment is not successful. From the individual-based model, middle childhood stunting does not have statistically influence the likelihood of school attendant and educational attainment.

This work is based on individual sample. Therefore, the estimations may be biased due to the effects of unobserved family and individual variables (Duncan et al. 1998, Glewwe et al. 2001). In ordered to eliminating the bias, the next step of the analysis will focus on sibling-based sample.

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