Child Health and Education in Developing Countries

By

Salai Thar Kei Myo

Dissertation

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

IN DEVELOPMENT POLICY

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ABSTRACT

CHILD HEALTH AND EDUCATION IN DEVELOPING COUNTRIES

By

SALAI THAR KEI MYO

This dissertation studies the effect of livelihoods skills upgrading program, community nutrition projects, education law on child's educational attainment and nutritional status in developing countries such as Myanmar, Ghana and Viet Nam.

Chapter one studies the livelihoods skills upgrading program which was implemented in 2012 across three agri-ecological zones of rural areas Myanmar and data collected in 2011, 2013 and 2015. In this study, we estimate the impacts of livelihoods skills upgrading program on child schooling (middle school, high school and university school), household poverty and monthly income in the program villages relative to the control villages. We find that the program strongly increases the probability of middle school level attended by 14.2 percent and high school level attended by 19.8 percent. And, no evidence of its impact on university school level attended across 2013 and 2015. However, the program has no impact on household poverty and their monthly income across 2011 and 2013, and 2011 and 2015 respectively.

Chapter two examines the effects of community nutrition projects-Spring Ghana on malnutrition in Ghana. The project objective was to reduce chronic malnutrition (stunting) within 1,000 days of a child, from conception to 2 years after birth by 20 percent. Using the

2011 and 2017 Ghana Multiple Indicator Cluster Survey (GMIC) dataset and employing the difference-in-difference strategy, we show a strong positive association of the project effect on the probability of stunting and underweight by 9 percentage points. However, we find no evidence of the project effect on acute malnutrition. Our results show the effectiveness of community nutrition projects on child health in Ghana.

Chapter three analyzes the impact of mother education on child health, child mortality and infant mortality by exploiting an exogeneous variation the law on primary school completion in 1991 in Viet Nam. Estimating the impact of maternal education on child health nutritional outcomes is employing the simple comparison of mother year of birth in 1979 and 1980, and mother birth cohorts 1980 and above till 1985, which is exploited from the Law on Universal Primary Education (LUPE). Our results show that primary school completion of mothers have no significant impact on child health outcomes: low height for age (stunting), low weight for age (underweight) and low weight for height (acute malnutrition), child mortality and infant mortality rates. In the simple comparison of mother birth cohorts in 1979 and 1980, primary school completion of mothers has an insignificant negative relationship with stunting and underweight while others have an insignificant positive relationship. Overall, it finds a negative relationship on child health outcomes. Specifically, competing primary schooling level (grade 2) of mother who were born in 1983 have significantly reduction on low height for age by 6.5 percentage points.

Keywords: livelihoods skills upgrading program, LIFT (Livelihood and Food Security Trust Fund) survey, Spring, Ghana, Law on Universal Primary Education (LUPE), difference in difference, Ordinary least square (OLS), child's schooling, poverty, monthly income, Child health, Child Mortality and Infant Mortality, Myanmar, Ghana, Viet Nam.

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TABLE OF COTENT

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CHAPTER ONE

THE IMPACTS OF LIVELIHOODS SKILL UPGRADING PROGRAM ON CHILD'S SCHOOLING AND POVERTY: THE CASE OF LIFT (LIVELIHOODS AND FOOD SECURITY TRUST FUND) PROGRAM IN RURAL MYANMAR

1.1 Introduction

The aim of this paper is to empirically investigate the livelihoods skill upgrading program impact on child's schooling which are middle school, high school and university school level attended, household poverty and household monthly income.

Myanmar with over 53 million population is the second largest country of land size in Southeast Asia with rich in natural resources and culture diversities. However, Myanmar is still one of the poorest countries among Southeast Asia countries. Around 70% of population live in the rural areas of Myanmar. Most of their main income mainly rely on agricultural activities and casual works. The major drawbacks of rural development are low returns to agriculture, and significantly lower levels of public service delivery and human development outcomes. Majority of people live with low income and poverty still mains the major issue. ADB and Myanmar Fact Sheet 2010; Saha (2011) stated that 32% of Myanmar population lived under the poverty line. And investment in health and education were quite low 0.5% and 1.3% of GDP respectively, especially in rural and remote areas. In the 2011, Myanmar being ranked 149 out of 187 countries in Human Development Index.

In order to increase food availability and income for two million poor and vulnerable people in Myanmar, multi-donor countries: Australia, Denmark, the European Union, the Netherlands, New Zealand, Sweden, Switzerland, and the United Kingdom build livelihoods skills upgrading program by LIFT-Livelihood and Food Security Trust Fund in rural Myanmar from 2011 to 2015. The program was started in 2012 and provided training and facilitating access to fundamental agricultural inputs, including credit to yield agriculture production, cash-for-work activities by constructing or repairing essential village infrastructures such as embankments, jetties, footpaths, bridges and culverts. Therefore, this study will estimate program impacts on child's schooling, household poverty and household monthly income across intervention years between program villages and control villages using Differences-in-Differences approach.

Skills training and poverty reduction have an obvious relationship in Skills Development in Sub-Saharan Africa (c.f. World Bank, 2004a). The benefits of skills development keep maintain the expectation on skills training advantages to economic growth and poverty reduction (cf. Working Group for International Cooperation in Skills Development, 2002, p. 16). LEAP-Livelihood Empowerment Against Poverty Program in Ghana reduced the likelihood of missing any school, reduced the chance of repeating a grade and decrease the chance of missing an entire week (Handa, S., Park, M., Darko, R. O., Osei-Akoto, I., Davis, B., & Daidone, S. 2013). Birdsall, N. (1985) studied that the positive effects of public inputs have a greater impact on child schooling. Handa, S., & Davis, B. (2006) found that the conditional cash transfer programs had positive impacts on school enrollment in developing countries. And Conditional Cash Transfers (PROGRESA) in Mexico found the positive impact on time at school outcome (Skoufias, E., Parker, S. W., Behrman, J. R., & Pessino, C. (2001)). Using LIFT household survey dataset 2013 and 2015, Chaw-Yin Myint, Milena Pavlova and Wim Groot studied that the catastrophic expenditures' incidence varied by the approach used to estimate expenditures. And Anu Rammohan and Bill Pritchard applied LIFT household survey 2011-12 dataset to see the land holding role to be a strong predictor of household food and nutrition security.

We find that the livelihoods skills upgrading program have a positive and significant impact on middle school level attended and high school level attended, and positive sign on university school level attended without significant. The program has an insignificant reduction on household poverty across 2011 and 2013, and across 2011 and 2015. And the program has no impact on their monthly income across 2011 and 2013, and across 2011 and 2015. The rest of the charters are laid down as follow. Section 1.2 describes the data description in each of the variables. Section 1.3 provides empirical strategy and model. It reports Difference-in-Difference method estimates the livelihood skills upgrading program impact on child's schooling, household poverty and monthly household income between program villages and control villages across the years. Section 1.4 presents empirical results of child's schooling such as middle school, high school and university school, household poverty and monthly household income including robustness checks and heterogeneous analysis. And section 1.5 concludes the study.

1.2 Data description

To implement our estimation, we used data from the LIFT (Livelihoods and Food Security Trust Fund) household survey which was conducted by LIFT partners ten development donors' countries. The dataset surveyed in three phases: 2011(September-November) as baseline, 2013 (October-November) as mid round, and 2015 as end line. The LIFT (Livelihoods and Food Security Trust Fund) program covered 76 townships in 8 of 15 states/regions in Myanmar. The dataset was across the three main broad agro-ecological zones such as Hilly zone, Dry zone, and Delta/Coastal zone. The data collection had done in a way of two-stage sampling process chosen with probability proportional to the number of households across 252 villages and included 4,000 households. 52 villages from cyclone Giri affected in Rakhine state will not be considered in the estimation since the survey did not make throughout in three phases. In each of the village, 16 households were randomly per village using a stratified multistage sampling procedure and collected detailed information such as socio-economic status, employment status and agricultural status.

The dependent variables were generated from the schooling age in the highest education level attended variables of LIFT-Livelihoods and Food Security Trust Fund household survey. The first dependent variable is children's schooling: middle school (10-14 years old of age), high school (14-16 years old of age) and university school (16-24 years old of age). The second dependent variable is poverty outcome which is calculated using foreign exchange rate (1,285 Kyats in a dollar) based on central bank of Myanmar and international poverty line (1.9$ per day) based on World Bank from the time of end-line survey 2015. We define a dummy for poverty which equals 1 below the poverty line and 0 for otherwise. And the third dependent variable is the natural log household monthly income. The independent variables are described in detail in the following descriptive statistics Table 1.1.

Table 1.1 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Middle (10 –14 years old)	3230	.524	.5	0	1
High (14 – 16 years old)	1,809	.224	.417	0	1
University (16 – 24 years old)	4,498	.075	.263	0	1
Poverty	8322	.361	.48	0	1
Log Monthly Income	8322	11.453	.807	9.433	13.459
Program village	8339	.772	.42	0	1
Child age	8339	16.303	4.14	10	24
Child female	8339	.513	.5	0	1
Housed Head Age	8339	45.315	10.575	17	84

Female respondent in Household	8339	.539	.499	0	1
Religion					
Buddhist	8339	.815	.388	0	1
Christian	8339	.176	.381	0	1
Hindu	8339	.001	.033	0	1
Islam	8339	.008	.089	0	1
Total Average Income (monthly)					
Less than Ks 25,000	8322	.049	.216	0	1
Ks 25,001 – Ks 50,000	8322	.146	.353	0	1
> Ks 50,001 – Ks 75,000	8322	.166	.372	0	1
> Ks 75,001 – Ks 100,000	8322	.18	.384	0	1
> Ks 100,001 – Ks 150,000	8322	.179	.383	0	1
> Ks 150,001 – Ks 200,000	8322	.111	.315	0	1
> Ks 200,001 – Ks 250,000	8322	.065	.247	0	1
> Ks 250,001 – Ks 300,000	8322	.034	.18	0	1
> Ks 300,001 – Ks 350,000	8322	.024	.154	0	1
> Ks 350,001 – Ks 400,000	8322	.014	.118	0	1
> Ks 400,001 – Ks 450,000	8322	.014	.119	0	1
> Ks 450,001 – Ks 500,000	8322	.006	.078	0	1
> Ks 500,001 – Ks 550,000	8322	.003	.051	0	1
> Ks 550,001 – Ks 600,000	8322	.001	.036	0	1
Over Ks 600,001	8322	.007	.085	0	1
Part Time Employment	8339	.019	.137	0	1
Full Time Employment	8339	.062	.241	0	1
Household own land	8339	.6	.49	0	1
Household own house	8339	.964	.186	0	1
Household owns Animals(cattle)	8339	.279	.449	0	1

***Note*:** In the dependent variables: middle school age is restricted between 10 and 14 years old, high school age is restricted between 14 and 16 years old and university school age are restricted between 16 and 24 years old, poverty outcome is calculated using foreign exchange rate (1,285 Kyats in a dollar) based on central bank of Myanmar and international poverty line (1.9$ per day) based on World Bank from the time of end-line survey 2015, and log of household monthly income is computed taking log of monthly average total income in levels, which are calculated in mean in each level.

1.3 Empirical Strategy

The main objective of our empirical strategy is to identify the causal effect of the livelihood's skills upgrading program impact on children's schooling, poverty and monthly income of households. The LIFT program was implemented from 2011 to 2015. In 200 villages, 150 LIFT (Livelihoods and Food Security Trust Fund) villages and 50 Control villages were randomly selected with probability proportional to size from the total number of villages located in three agro-ecological zones under the livelihood's skills upgrading program. Therefore, this setting motivates to apply Difference-in-Difference approach to estimate the

program impact on child's schooling across 2013 and 2015, household poverty and household monthly income across 2011, 2013 and 2015 across the program villages and control villages.

Model,

$$Y_{ijt} = \alpha + \beta_1 Post_t + \beta_2 Program_{ij} + \beta_3 Post_t \times Program_{ij} + \beta_4 X_{ijt} + \delta_j + \varepsilon_{ijt}$$

where *i* denote individuals for child's schooling outcomes or household for poverty and monthly income outcomes, *j* denotes village, and *t* denotes year. For the first outcome, Y_{ijt} indicates a set of outcome variables as a dummy for child's schooling level attended: middle school, high school and university level respectively, where $Post_t$ take value 1 for the year of 2015 and 0 for the year of 2013. $Program_{ij}$ is a dummy variable which takes value 1 if program villages and 0 if control villages. For the second outcome, Y_{ijt} indicates a dummy outcome for household poverty, where $Post_t$ takes value 1 for the year of 2015 and 0 for the year of 2011 to see long term impact, and also estimate the short-term impact where it takes 1 for 2013 and 0 for 2011 respectively. For the third outcome, Y_{ijt} indicates the natural log of household monthly income, where $Post_t$ take value 1 for the year of 2015 and 0 for the year of 2011 to see long term impact, and also estimate the short-term impact where it takes 1 for 2013 and 0 for 2011 respectively. β_3 is the program impact. X_{ijt} represents family characteristics (child age, child gender, household head age and gender), ethnicities groups, religious groups, households' total average monthly income in rage, employment status (part-time and full-time), housing characteristics (roofing materials, floor materials, wall materials), household ownerships (motorcycle, radio, cellphone, own house), household savings status, total agricultural land areas (measured by acres), household grows grow any crop on their farm land, ownerships on agricultural equipment (power tillers and cattle) and crop selling status (paddy, cereals, beans, fish and live stocks). δ_j indicates village fixed effect. And ε_{ijt} indicates the error term clustered at the village level.

1.3.1 Balance test

Table 1.2 Balance test (2011 Baseline)

Variable(s)	Mean Control	Mean Treated	Diff.	t-test	Pr(T>t)
HHAge	45.391	45.104	-0.287	0.50	0.6181
HHSex (female=1)	0.477	0.478	0.001	0.04	0.9688

Full time employment	0.050	0.057	0.006	0.68	0.4947
Part time employment	0.016	0.021	0.005	0.81	0.4160
Sale of paddy	0.128	0.145	0.017	1.16	0.2442
Sale of cereals	0.224	0.183	-0.041	2.52	0.0117**
Sale of beans	0.256	0.222	-0.034	2.00	0.0461**
Sale of fish	0.060	0.061	0.001	0.05	0.9575
Sale of livestock	0.095	0.094	-0.002	0.13	0.8991
HH own land	0.595	0.531	-0.064	3.17	0.0016***
HH own Agri-equipment	0.343	0.309	-0.034	1.80	0.0724*
Animals (cattle)	0.291	0.264	-0.027	1.49	0.1351
Power tiller	0.044	0.044	0.000	0.05	0.9570
Lighting	31.191	25.697	-5.494	3.60	0.0003***
Cooking fuel	6.513	7.226	0.714	1.32	0.1862
Motorcycle	0.206	0.207	0.001	0.05	0.9632
Cell phone	0.015	0.028	0.013	2.05	0.0409**
Solar panel	0.014	0.026	0.012	1.93	0.0533*
Radio	0.411	0.387	-0.024	1.18	0.2372
HH Savings	0.053	0.056	0.003	0.32	0.7460
HH own house	0.952	0.937	-0.015	1.57	0.1159
Roof	3.343	4.411	1.068	2.01	0.0444**
Wall	3.514	3.284	-0.230	2.52	0.0119**
Floor	2.069	2.373	0.304	1.08	0.2802

*** p<0.01; ** p<0.05; * p<0.1

Table 1.2 presents balancing test, where we check balancing test in all variables in this study, whether observed and unobserved covariates are balanced between the treatment and control groups or not. In table 1.2, among all covariates, only 20% of them have significant different and their coefficient of mean different between treatment and control have more than 5 percent. Since 80% of covariates are balancing in mean different value of treatment and control group, we may assume that they are matching among them.

1.4 Empirical Results

The results are shown in the following sections: child's schooling outcome in section 1.4.1, poverty outcome in section 1.4.2, monthly income outcome in section 1.4.3 and heterogeneous analysis in section 1.4.4 respectively.

1.4.1 Child's Schooling Outcome

In this section, we discuss the main estimated outcomes of child's schooling (middle school, high school and university school), household poverty and household monthly income.

Table 1.3 describes the middle school outcome (schooling age: 10-14 years). Table 1.4 shows the result of middle school outcome (schooling age: 14-16 years). Table 1.5 presents the university school outcome (schooling age: 16-24 years). Table 1.6 and 1.7 describes the poverty outcome which is calculated using foreign exchange rate (1,285 Kyats in a dollar) based on central bank of Myanmar and international poverty line (1.9$ per day) based on World Bank from the time of end-line survey 2015, estimated long term impact (2011-2015), and short-term impact (2011-2013) respectively. Table 1.8 and 1.9 describes the monthly income outcome which take natural log, estimated long term impact (2011-2015), and short-term impact (2011-2013) respectively. Birdsall, N. (1985) also found that that the positive effects of public inputs have a greater impact on child schooling in both rural and urban areas of Brazil.

Table 1.3 Middle School Outcome (2013-2015)

VARIABLES	(1) Middle School	(2) Middle School	(3) Middle School
Post (=2015)	-0.132***	-0.163***	-0.158**
	(0.0468)	(0.0443)	(0.0627)
Program village	-0.0947**	-0.0953**	-0.0652
	(0.0414)	(0.0397)	(0.0546)
Post*Program village	0.165***	0.149***	0.142*
	(0.0534)	(0.0478)	(0.0734)
Household controls	No	Yes	Yes
Village FE	No	No	Yes
Constant	0.599***	-0.963***	-0.865***
	(0.0358)	(0.0942)	(0.108)
Observations	3,230	3,225	3,225
R-squared	0.005	0.188	0.297

Note: A robust estimate of the variance clustered standard error at village level in each regression parentheses. The periods are 2013 and 2015. The dependent variable is middle schooling level (10-14 years old age). In column (1), Diff-in-Diff estimate is reported. Column (2) includes household controls. Column (3) includes household controls, village fixed effect. "Post" refers a dummy indicator which takes 1 value for 2015 and 0 for 2013. The dummy for program village equals 1 for program villages and 0 for control villages.

Household controls includes are family characteristics (child age, child gender, household head age and household gender), ethnicities and religious groups, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), average total monthly income in range, dummy for employment status (part-time and full-time), total land areas in acres,

dummy for agricultural equipment ownership (cattle, power tiller), dummy for selling crops status (paddy, cereals, beans, fish and live-stocks) and village fixed effect. *** *p<0.01, ** p<0.05, * p<0.1*

Table 1.3 describes the program impact on middle school outcome. Column (1) shows simple Diff-in-Diff estimate, column (2) is with household controls and column (3) is revealed with all control variables including villages fixed, and the coefficient of the interaction "*Post*Program village*" where the school age children in the program villages statistically and significantly increase the probability of middle schooling level attended by 14.2 percentage point relative to children in the control villages.

Table 1.4 High School Outcome (2013-2015)

VARIABLES	(1) High School	(2) High School	(3) High School
Post (=2015)	-0.0256	-0.0957*	-0.218**
	(0.0541)	(0.0528)	(0.0889)
Program village	-0.0164	-0.0248	-0.140**
	(0.0454)	(0.0433)	(0.0687)
Post*Program village	0.0279	0.0172	0.198*
	(0.0609)	(0.0560)	(0.102)
Household controls	No	Yes	Yes
Village FE	No	No	Yes
Constant	0.239***	-1.477***	-1.559***
	(0.0405)	(0.176)	(0.203)
Observations	1,809	1,807	1,807
R-squared	0.000	0.148	0.350

Note: A robust estimate of the variance clustered standard error at village level in each regression parentheses. The periods are 2013 and 2015. The dependent variable is high schooling level (14-16 years old age). In column (1), Diff-in-Diff estimate is reported. Column (2) includes household controls. Column (3) includes household controls, and village fixed effect. "Post" refers a dummy indicator which takes 1 value for 2015 and 0 for 2013. The dummy for program village equals 1 for program villages and 0 for control villages.

Household controls includes are family characteristics (child age, child gender, household head age and household gender), ethnicities and religious groups, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), average total monthly income in range, dummy for employment status (part-time and full-time), total land areas in acres, dummy for agricultural equipment ownership (cattle, power tiller) , dummy for selling crops status (paddy, cereals, beans, fish and live-stocks), and village fixed effect. *** *p<0.01, ** p<0.05, * p<0.1*

Table 1.4 presents the effect program impact on high school outcome. The results show that the program have an insignificant positive sign on high school level attended in the program villages compared to the control villages with program itself in column (1) and household controls in column (2). But, adding household controls and villages fixed effect in column (3), the program impact statistically and significantly increased the probability of high school level attended by 19.8 percentage points relative to children in the control villages.

Table 1.5 University Attendance Outcome (2013-2015)

VARIABLES	(1) University	(2) University	(3) University
Post (=2015)	0.00309	-0.0551**	-0.0729**
	(0.0215)	(0.0227)	(0.0367)
Program village	-0.00406	-0.00194	-0.0274
	(0.0162)	(0.0151)	(0.0273)
Post*Program village	0.00875	-0.00419	0.0445
	(0.0244)	(0.0234)	(0.0434)
Household controls	No	Yes	Yes
Village FE	No	No	Yes
Constant	0.0728***	-0.137***	-0.161***
	(0.0141)	(0.0416)	(0.0561)
Observations	4,498	4,486	4,486
R-squared	0.000	0.089	0.174

Note: A robust estimate of the variance clustered standard error at village level in each regression parentheses. The periods are 2013 and 2015. The dependent variable is university schooling level (16-24 years old age). Diff-in-Diff estimate is reported in column (1) and column (2) adds household controls. Column (3) includes household controls and village fixed effect. "Post" refers a dummy indicator which takes 1 value for 2015 and 0 for 2013. The dummy for program village equals 1 for program villages and 0 for control villages.

Household controls includes are family characteristics (child age, child gender, household head age and household gender), ethnicities and religious groups, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), average total monthly income in range, dummy for employment status (part-time and full-time), total land areas in acres, dummy for agricultural equipment ownership (cattle, power tiller) , dummy for selling crops status (paddy, cereals, beans, fish and live-stocks), and village fixed effect. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.5 show the result for the program effect on university school outcome. Across the program itself in column (1), household controls in column (2), and all controls and village fixed effect in column (3), the livelihoods skills upgrading program have a positive relationship on university school level attended to the students in program villages relative to the students in control villages although there is no significant impact.

1.4.2 Poverty Outcome

This section describes the results of program impact on poverty across 2011 and 2013 in table 1.6 and long-term impact (2011-2015) in table 1.7 respectively in the following.

Table 1.6 Poverty (2011-2013)

VARIABLES	(1) Poverty	(2) Poverty	(3) Poverty
Post (=2013)	-0.0974**	-0.0606*	-0.0573
	(0.0388)	(0.0337)	(0.0558)
Program village	-0.0218	-0.00827	-0.0142
	(0.0293)	(0.0247)	(0.0473)
Post*Program village	-0.0532	-0.0393	-0.0501
	(0.0473)	(0.0393)	(0.0730)
Household Controls	No	Yes	Yes
Village FE	No	No	Yes
Constant	0.735***	0.736***	0.606***
	(0.0239)	(0.0907)	(0.101)
Observations	6,380	6,380	6,380
R-squared	0.023	0.213	0.297

Note: A robust estimate of the variance clustered standard error at village level in each regression parentheses. The periods are 2011 and 2013. The dependent variable is poverty outcome which is calculated using foreign exchange rate (1,285 Kyats in a dollar) based on central bank of Myanmar and international poverty line (1.9$ per day) based on World Bank from the time of end-line survey 2015. In column (1), Diff-in-Diff estimate is reported. Column (2) includes household controls. Column (3) includes household controls, and village fixed effect. "Post" refers a dummy indicator which takes 1 value for 2013 and 0 for 2011. The dummy for program village equals 1 for program villages and 0 for control villages.

Household controls includes are family characteristics (child age, child gender, household head age and household gender, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), total average monthly income in range, dummy for

employment status (part-time and full-time), total land areas in acres, dummy for agricultural equipment ownership (cattle, power tiller), dummy for selling crops status (paddy, cereals, beans, fish and live-stocks), and village fixed effect. *** *p<0.01, ** p<0.05, * p<0.1*

Table 1.6 shows the short-term program impact on poverty outcome. Column (1) reveals Diff-in-Diff itself estimation and column (2) reports Diff-in-Diff itself and with household controls. In column (3) of Diff-in-Diff with household controls, and village fixed effect, the livelihoods skills upgrading program have only negative relationship and no significant reduction on poverty in household from program village relative to households from the control villages.

Table 1.7 Poverty (2011-2015)

VARIABLES	(1) Poverty	(2) Poverty	(3) Poverty
Post (=2015)	-0.425***	-0.312***	-0.357***
	(0.0330)	(0.0345)	(0.0526)
Program village	-0.0218	-0.0110	-0.0528
	(0.0293)	(0.0255)	(0.0386)
Post*Program village	0.00505	0.0118	0.0802
	(0.0391)	(0.0345)	(0.0629)
Household Controls	No	Yes	Yes
Village FE	No	No	Yes
Constant	0.735***	0.657***	0.446***
	(0.0239)	(0.0691)	(0.0748)
Observations	7,980	7,980	7,980
R-squared	0.172	0.288	0.343

Note: A robust estimate of the variance clustered standard error at village level in each regression parentheses. The periods are 2011 and 2015. The dependent variable is poverty outcome which is calculated using foreign exchange rate (1,285 Kyats in a dollar) based on central bank of Myanmar and international poverty line (1.9$ per day) based on World Bank from the time of end-line survey 2015. In column (1), Diff-in-Diff estimate is reported. Column (2) includes household controls. Column (3) includes household controls, and village fixed effect. "Post" refers a dummy indicator which takes 1 value for 2015 and 0 for 2011. The dummy for program village equals 1 for program villages and 0 for control villages.

Household controls includes are family characteristics (child age, child gender, household head age and household gender, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), total average monthly income in range, dummy for

employment status (part-time and full-time), total land areas in acres, dummy for agricultural equipment ownership (cattle, power tiller), dummy for selling crops status (paddy, cereals, beans, fish and live-stocks), and village fixed effect. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.7 describes the long-term program impact on poverty outcome. Across all three columns, the program itself in column (1), with household controls in column (2) and with village fixed effect in column (3), the program has no significant reduction on poverty in the long run of 2011 to 2015 under livelihoods skills upgrading program intervention in the program villages compared to the control villages.

1.4.3 Monthly Income

In this section, the results of the program impact on household monthly income in the following sections: short-term impact (2011-2013) in table 1.8 and long-term impact (2011-2015) in table 1.9 respectively.

Table 1.8 Monthly Income (2011-2013)

VARIABLES	(1) Log of Monthly Income	(2) Log of Monthly Income	(3) Log of Monthly Income
Post (=2013)	0.185***	0.0923	0.117
	(0.0709)	(0.0614)	(0.103)
Program village	0.0612	0.0295	0.0600
	(0.0536)	(0.0441)	(0.0854)
Post*Program village	0.0459	0.0231	0.00622
	(0.0845)	(0.0683)	(0.126)
Household Controls	No	Yes	Yes
Village FE	No	No	Yes
Constant	10.80***	10.97***	11.17***
	(0.0444)	(0.132)	(0.167)
Observations	6,360	6,360	6,360
R-squared	0.023	0.280	0.396

Note: A robust estimate of the variance clustered standard error at village level in each regression parentheses. The periods are 2011 and 2013. The dependent variable is the natural log of monthly income, computed taking log of monthly average total income in levels, which are calculated in mean in each level. In column (1), Diff-in-Diff estimate is reported. Column (2) includes household controls. Column (3) includes household controls and village fixed effect. "Post" refers a dummy indicator which

takes 1 value for 2013 and 0 for 2011. The dummy for program village equals 1 for program villages and 0 for control villages.

Household controls includes are family characteristics (child age, child gender, household head age and household gender, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), total average monthly income in range, dummy for employment status (part-time and full-time), total land areas in acres, dummy for agricultural equipment ownership (cattle, power tiller), dummy for selling crops status (paddy, cereals, beans, fish and live-stocks), and village fixed effect. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.8 presents short term impact of program on the natural log of household monthly income from 2011 to 2013. Diff-in-Diff itself estimation is in column (1), the estimation of Diff-in-Diff itself with household controls is in column (2), and Diff-in-Diff with all controls and village fixed effect in column (3), the coefficient of interaction term "*Post*Program village*", the program effect overall has an insignificant positive sign on monthly income of households in the livelihood's skills upgrading program villages compared to the households in the control villages. The result is reflecting with the poverty's result in table 1.6.

Table 1.9 Monthly Income (2011-2015)

VARIABLES	(1) Log of Monthly Income	(2) Log of Monthly Income	(3) Log of Monthly Income
Post (=2015)	0.722***	0.454***	0.494***
	(0.0690)	(0.0643)	(0.0978)
Program village	0.0612	0.0371	0.0934
	(0.0536)	(0.0449)	(0.0692)
Post*Program village	-0.0209	-0.0459	-0.117
	(0.0810)	(0.0679)	(0.120)
Household Controls	No	Yes	Yes
Village FE	No	No	Yes
Constant	10.80***	10.94***	11.20***
	(0.0444)	(0.112)	(0.125)
Observations	7,973	7,973	7,973
R-squared	0.163	0.377	0.449

Note: A robust estimate of the variance clustered standard error at the village level in each regression parentheses. The periods are 2011 and 2015. The dependent variable is the natural log of monthly income, computed taking log of monthly average total income in levels, which are calculated in mean in each level. In column (1), Diff-in-Diff estimate is reported. Column (2) includes household controls.

Column (3) includes household controls, and village fixed effect. "Post" refers a dummy indicator which takes 1 value for 2015 and 0 for 2011. The dummy for program village equals 1 for program villages and 0 for control villages.
Household controls includes are family characteristics (child age, child gender, household head age and household gender, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), total average monthly income in range, dummy for employment status (part-time and full-time), total land areas in acres, dummy for agricultural equipment ownership (cattle, power tiller), dummy for selling crops status (paddy, cereals, beans, fish and live-stocks), and village fixed effect. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.9 presents long term impact of program on the natural log of household monthly income from 2011 to 2015. The coefficient of interaction term "*Post*Program village*", the program effect has a negative relationship on monthly income in both column (1) of only program itself, column (2) with household controls, and the last column (3) of adding household controls and villages fixed effect, the interaction term of program effect "*Post*Program village*" also have a negative relationship with monthly income of households under the livelihoods skills upgrading program villages in the comparison of households in the program villages and control villages, which is agreeing with the poverty result in table 1.7.

1.4.4 Robustness Checks

The validity of estimation procedures used in this analysis of binary data are mainly dependent on whether the model assumptions are convinced or not. A robust logistic regression was introduced by minimizing the mean-squared deviance for the worst-case contamination (Kordzakhia, N., Mishra, G. D., & Reiersølmoen, L. (2001)). To enhance the precision of the estimated effects, and as a check on the robustness of the results, we also try a robust estimator for the logistic regressions for binary outcomes to estimate the parameters in case of outliers or influential observations. Timmerman et al. applied the logistic regression to differentiate between benign and malignant adnexal mass before surgery. Merritt et al. did apply the binary logistic regression to examine the role of dairy food intake and risk of ovarian cancer.

We check robustness using logistic regression since the outcome is binary data. A robust estimate of the variance cluster standard error (VCE) is used since the regression is innately heteroskedastic. Table 1.10 presents the robustness check of child schooling across 2013 and 2015 by logistic regression. As expected, the effects are of similar magnitude to the average implied effects reported in table 1.3, 1.4 and 1.5 respectively. In column (1), the children in the

program villages have a marginal effect 0.12 more middle school attending than those in the control villages after controlling other explanatory variables. In column (2), the average marginal effect of middle schooling age children in the program villages on those in the control villages is 0.21. In column (3), the children from the program villages have a positive marginal effect on the university schooling compared to those in the control villages.

We also describe the robustness check of child schooling across 2013 and 2015 using an alternative method which is interacting between post (2015) year dummy and all the control variables in table 1.11. As expected, the results are still consistent with the main results in table 1.3, 1.4 and 1.5 respectively. The children in the program villages have an average marginal effect on middle school by 0.14 in column (1), high school by 0.20 in column (2), and positive effect on university school related to children in the control villages in column (3).

Table 1.12 reports the robustness check of binary response poverty outcome implying logistic regression across 2011 and 2013, and 2011 and 2015 respectively. The livelihoods skills upgrading program have no reduction on poverty in households from program village relative to households from the control villages across 2011 and 2013 in column (1) and have an insignificant relationship with household poverty across 2011 and 2015 in column (2), which are consistent with the main results table 1.6 and 1.7 respectively.

Table 1.13 probes the robustness check of log of monthly income by interacting post year dummy and all the controls variables across 2011 and 2013, and 2011 and 2015 respectively. The livelihoods skills upgrading program have no impact on the monthly household income in all columns. The results find that the program have an insignificant positive relationship with household monthly income across 2011 and 2013, and have a negative relationship with household monthly income across 2011 and 2015. As expected, the results have similar magnitude with the main results in table 1.8 and 1.9 respectively.

Table 1.10 Child Schooling: Middle, High and University (2013 vs 2015) by logistic regression

VARIABLES	(1) Middle School	(2) High School	(3) University
Post (=2015)	-0.810**	-1.958***	-1.169**
	(0.338)	(0.733)	(0.590)
Program village	-0.328	-1.222**	-0.352
	(0.291)	(0.574)	(0.426)
Post*Program	0.127*	0.218**	0.042
	(0.069)	(0.110)	(0.059)

Household controls	Yes	Yes	Yes
Village FE	Yes	Yes	Yes
Constant	-7.542***	-17.72***	-7.429***
	(0.623)	(1.920)	(1.244)
Observations	3,135	1,298	2,768

Note: A robust estimate of the variance clustered standard error at village level in each regression parentheses. This table reports robustness check of child's schooling by logistic regression. The periods are 2013 and 2015. The dependent variable is middle school level (10-14 years old age), high school level (14-16 years old age) and university school level (16-24 years old age). In column (1), Diff-in-Diff estimate is reported. Column (2) includes household controls. Column (3) includes household controls, village fixed effect. "Post" refers a dummy indicator which takes 1 value for 2015 and 0 for 2013. The dummy for program village equals 1 for program villages and 0 for control villages.
Household controls includes are family characteristics (child age, child gender, household head age and household gender), ethnicities and religious groups, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), average total monthly income in range, dummy for employment status (part-time and full-time), total land areas in acres, dummy for agricultural equipment ownership (cattle, power tiller), dummy for selling crops status (paddy, cereals, beans, fish and live-stocks) and village fixed effect. *** *p<0.01, ** p<0.05, * p<0.1*

Table 1.11 Child Schooling: Middle, High and University (2013 vs 2015) by interacting between post year dummy and all the control variables.

VARIABLES	(1) Middle School	(2) High School	(3) University
Post (=2015)	-0.337	-0.276	-0.0567
	(0.230)	(0.424)	(0.0997)
Program village	-0.0804	-0.146**	-0.0314
	(0.0551)	(0.0689)	(0.0271)
Post*Program village	0.148*	0.206**	0.0478
	(0.0758)	(0.104)	(0.0438)
Household controls	Yes	Yes	Yes
Village FE	Yes	Yes	Yes
Constant	-0.719***	-1.582***	-0.152*
	(0.183)	(0.307)	(0.0804)
Observations	3,225	1,807	4,486
R-squared	0.306	0.365	0.186

Note: A robust estimate of the variance clustered standard error at village level in each regression parentheses. This table reports robustness check of child's schooling by alternative way, interacting between post year dummy and all the control variables. The periods are 2013 and 2015. The dependent variable is middle school level (10-14 years old age), high school level (14-16 years old age) and university school level (16-24 years old age). In column (1), Diff-in-Diff estimate is reported. Column (2) includes household controls. Column (3) includes household controls, village fixed effect. "Post" refers a dummy indicator which takes 1 value for 2015 and 0 for 2013. The dummy for program village equals 1 for program villages and 0 for control villages.

Household controls includes are family characteristics (child age, child gender, household head age and household gender), ethnicities and religious groups, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), average total monthly income in range, dummy for employment status (part-time and full-time), total land areas in acres, dummy for agricultural equipment ownership (cattle, power tiller), dummy for selling crops status (paddy, cereals, beans, fish and live-stocks) and village fixed effect. *** *p<0.01, ** p<0.05, * p<0.1*

Table 1.12 Poverty by logistic regression

VARIABLES	(2) Poverty (2011-2013)	(1) Poverty (2011-2015)
Post	-0.352	-1.986***
	(0.312)	(0.308)
Program village	-0.0342	-0.271
	(0.270)	(0.228)
Post*Program village	-0.334	0.076
	(0.414)	(0.060)
Household Controls	Yes	Yes
Village FE	Yes	Yes
Constant	0.844	-0.376
	(0.641)	(0.477)
Observations	6,300	7,834

Note: A robust estimate of the variance clustered standard error at village level in each regression parentheses. This table reports robustness check of household poverty by logistic regression. The periods are 2013 and 2015, 2011 and 2015, and 2011 and 2013. The dependent variable is poverty outcome which is calculated using foreign exchange rate (1,285 Kyats in a dollar) based on central bank of Myanmar and international poverty line (1.9$ per day) based on World Bank from the time of end-line survey 2015. In column (1), Diff-in-Diff estimate is reported. Column (2) includes household controls. Column (3) includes household controls, and village fixed effect. "Post" refers a dummy indicator which takes 1 value for 2013 and 0 for 2011 in column (1), and 1 for 2015 and 0 for 2011 in

column (2), respectively. The dummy for program village equals 1 for program villages and 0 for control villages.

Household controls includes are family characteristics (child age, child gender, household head age and household gender), ethnicities and religious groups, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), total average monthly income in range, dummy for employment status (part-time and full-time), total land areas in acres, dummy for agricultural equipment ownership (cattle, power tiller), dummy for selling crops status (paddy, cereals, beans, fish and live-stocks), and village fixed effect. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.13 Monthly Income by interacting between post dummy and all control variables

VARIABLES	(1) Log of Monthly Income (2011-2013)	(1) Log of Monthly Income (2011-2015)
Post	0.314	0.425*
	(0.280)	(0.232)
Program village	0.0577	0.0857
	(0.0828)	(0.0666)
Post*Program village	0.0225	-0.119
	(0.122)	(0.117)
Household Controls	Yes	Yes
Village FE	Yes	Yes
Constant	11.07***	11.29***
	(0.206)	(0.185)
Observations	6,360	7,973
R-squared	0.404	0.455

Note: A robust estimate of the variance clustered standard error at village level in each regression parentheses. The periods are 2013 and 2015, 2011 and 2015, and 2011 and 2013. This table reports robustness check of natural log of household monthly income by interacting between post year dummy and all the control variables. The dependent variable is the natural log of monthly income, computed taking log of monthly average total income in levels, which are calculated in mean in each level. In column (1), Diff-in-Diff estimate is reported. Column (2) includes household controls. Column (3) includes household controls, and village fixed effect. "Post" refers a dummy indicator which takes 1 value for 2013 and 0 for 2011 in column (1), and 1 for 2015 and 0 for 2011 in column (2), respectively. The dummy for program village equals 1 for program villages and 0 for control villages.

Household controls includes are family characteristics (child age, child gender, household head age and household gender, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), total average monthly income in range, dummy for

employment status (part-time and full-time), total land areas in acres, dummy for agricultural equipment ownership (cattle, power tiller), dummy for selling crops status (paddy, cereals, beans, fish and live-stocks), and village fixed effect. *** *p<0.01, ** p<0.05, * p<0.1*

1.4.5 Heterogeneity Analysis

We do extra experiments to examine the differential effects of livelihoods skills upgrading program impact on child's schooling and household poverty. The following sections examine heterogeneous analysis by taking dummy for gender (value 1 if female and 0 if male), dummy for zones (value 1 if hilly zones and 0 if dry/delta), dummy for poor (value 1 if poor and 0 if non-poor), and dummy for ethnicity (value 1 if minority and 0 if biggest group, Bamar) under the program villages compared to the control villages. Section 1.4.5.1 describes the heterogeneous analysis on child's schooling by heterogeneous effects on middle school in table 1.14, and heterogeneous effects on high school in table 1.15.

1.4.5.1 **Heterogeneity Analysis on Child's Schooling**

Table 1.14 Heterogeneous Effects on Middle School

VARIABLES	(1) Middle School	(2) Middle School	(3) Middle School	(4) Middle School
Post (=2015)	-0.197***	-0.167**	-0.229***	-0.0817
	(0.0695)	(0.0767)	(0.0711)	(0.0776)
Program village	-0.101*	-0.0429	-0.140**	-0.0317
	(0.0571)	(0.0605)	(0.0637)	(0.0608)
Post*Program	0.198**	0.187**	0.194**	0.0308
	(0.0791)	(0.0842)	(0.0799)	(0.0865)
Post*female	0.0797			
	(0.0740)			
Program*Female	0.0720			
	(0.0659)			
Post*Program*Female	-0.115			
	(0.0838)			
Hilly region		-0.0453		
		(0.101)		
Post*Hilly		0.0812		
		(0.138)		
Program*Hilly		-0.0558		
		(0.0951)		
Post*Program*Hilly		-0.144		

		(0.138)		
Poor			-0.0951	
			(0.137)	
Post*Poor			0.0975	
			(0.0822)	
Program*Poor			0.120*	
			(0.0701)	
Post*Program*Poor			-0.0527	
			(0.0920)	
Minority				-0.151
				(0.163)
Post*Minority				-0.156
				(0.125)
Program*Minority				-0.0747
				(0.0886)
Post*Program*Minority				0.281**
				(0.130)
Household controls	Yes	Yes	Yes	Yes
Village FE	Yes	Yes	Yes	Yes
Observations	3,225	3,225	3,225	3,225
R-squared	0.297	0.299	0.298	0.298

Note: A robust estimate of the variance clustered standard error at village level in each regression parentheses. The periods are 2013 and 2015. The dependent variable is middle school (10-14 years old age) across heterogeneous analysis on dummy for female and male child in column (1), dummy for hilly and dry/delta zones in column (2), dummy for poor and non-poor in column (3), dummy for ethnic minority and biggest ethnic group (Bamar) in column (4). "Post" refers a dummy indicator which takes 1 value for 2015 and 0 for 2013. The dummy for program village equals 1 for program villages and 0 for control villages.

Household controls includes are family characteristics (child age, child gender, household head age and household gender), ethnicities and religious groups, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), average total monthly income in range, dummy for employment status (part-time and full-time), total land areas in acres, dummy for agricultural equipment ownership (cattle, power tiller) , dummy for selling crops status (paddy, cereals, beans, fish and live-stocks), village fixed effect, states and regions fixed effects and year time trends. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.14 shows the heterogeneous effects of the program impact on middle school outcome across gender (female and male), zones (hilly and dry/delta), poor and non-poor, and ethnicity (minority groups and Bamar) controlling household characteristics, and village fixed effect. The findings show that the program statistically significant increase the probability of middle school level attended on students from minority groups by 28.1 percentage points

relative to students from largest ethnic (Bamar) under livelihoods skills upgrading program villages. Under the program villages, girls are less likely to complete the middle school compared to boys, students from poor households and hilly regions are less likely to finish the middle schooling. Middle schooling age of girls are more likely drop out due to households are poor and enter to job market to support their family, then turned to be child labors.

Table 1.15 Heterogeneous Effect of High School

VARIABLES	(1) High School	(2) High School	(3) High School	(4) High School
Post (=2015)	-0.194**	-0.118	-0.285***	-0.149
	(0.0924)	(0.111)	(0.108)	(0.122)
Program village	-0.0684	-0.0942	-0.233**	-0.0694
	(0.0783)	(0.0859)	(0.0934)	(0.0849)
Post*Program village	0.146	0.146	0.271**	0.139
	(0.109)	(0.124)	(0.120)	(0.137)
Post*Female	-0.0492			
	(0.0940)			
Program*Female	-0.150*			
	(0.0786)			
Post*Program*Female	0.109			
	(0.107)			
Hilly		0.145		
		(0.161)		
Post*Hilly		-0.268		
		(0.223)		
Program*Hilly		-0.122		
		(0.134)		
Post*Program*Hilly		0.117		
		(0.209)		
Poor			-0.130	
			(0.245)	
Post*Poor			0.0703	
			(0.0822)	
Program*Poor			0.158**	
			(0.0753)	
Post*Program*Poor			-0.0739	
			(0.0914)	
Minority				-0.268
				(0.165)
Post*Minority				-0.180
				(0.184)
Program*Minority				-0.160
				(0.123)
Post*Program*Minority				0.139
				(0.190)

Household controls	Yes	Yes	Yes	Yes
Village FE	Yes	Yes	Yes	Yes
Constant	-1.614***	-1.588***	-1.524***	-1.670***
	(0.208)	(0.219)	(0.306)	(0.213)
Observations	1,807	1,807	1,807	1,807
R-squared	0.352	0.352	0.353	0.351

Note: A robust estimate of the variance clustered standard error at village level in each regression parentheses. The periods are 2013 and 2015. The dependent variable is high school (14-16 years old age) across heterogeneous analysis on dummy for female and male child in column (1), dummy for hilly and dry/delta zones in column (2), dummy for poor and non-poor in column (3), dummy for ethnic minority and biggest ethnic group (Bamar) in column (4). "Post" refers a dummy indicator which takes 1 value for 2015 and 0 for 2013. The dummy for program village equals 1 for program villages and 0 for control villages.

Household controls includes are family characteristics (child age, child gender, household head age and household gender), ethnicities and religious groups, housing characteristics (roof, wall and floor), dummy for household ownerships (motorcycle, radio, cellphone and solar panel), average total monthly income in range, dummy for employment status (part-time and full-time), total land areas in acres, dummy for agricultural equipment ownership (cattle, power tiller) , dummy for selling crops status (paddy, cereals, beans, fish and live-stocks), village fixed effect, states and regions fixed effects and year time trends. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 1.15 presents the heterogeneous effects of the program impact on high school outcome across gender (female and male), zones (hilly and dry/delta), poor and non-poor, and ethnicity (minority groups and Bamar) controlling household characteristics and village fixed effect. Under across the livelihoods skills upgrading program villages and control villages, the program have a positive relationship on female students relative to male students in column (1) the fact that girls have less chance to drop out of school since they entered the high school, positive sign on students from hilly compared to students from dry/delta zones in column (2), and positive relationship on students from minority groups relative to students from largest ethnic (Bamar) in column (4). However, the students from the poor households are less likely to finish high school compared to students from non-poor households in column (3).

1.5. Conclusions

This study estimates the effect of livelihoods skills upgrading program impact on child's schooling, household poverty and household monthly income in rural Myanmar. Due

to the program design to the specific treatment villages and control villages, this setting enables us to implement a different-in-differences strategy to study the impacts of livelihoods skills upgrading program.

Our findings provide that the livelihoods skills upgrading program statistically and significantly increased middle school and high school level attended and generally have a positive effect on university school level attended. Overall, the program has no significant impact on poverty reduction in the short-term period (2011-2013) and the long-term period (2011-2015). In the following, the program overall has no effect on household monthly income across all term throughout the intervention. The results indicate that the probability of middle schooling level attended is significantly increased by 14.2 percentage point, and the probability of high school level attended is significantly increased by 19.8 percentage point although university school level attended only have positive relationship under the livelihoods skills upgrading program across 2013 and 2015. Overall analysis suggest that the program significantly increases middle school level attended mainly students from minority group by 28.1 percentage points, negative relationship on middle school in female students from poor households and hilly zones.

Consequently, the livelihoods skills upgrading program have a significant positive impact on middle school and high school level attended, and it has insignificant relationship on university school level attended across 2013 and 2015. However, the program has no significant negative impact on household poverty and monthly income across all term: 2011-2013, and 2011-2015. The investigations in the paper suggest that skills upgrading and livelihood programs may have significant positive effects in improving the education outcome for the next generation. These effects should be incorporated into the policy analysis. On the other hand, the evidence suggests that the LIFT interventions are not doing a good job in reducing rural poverty and enhancing rural income, the main program objectives. We should critically review the program contents and the program implementation, and natural disasters throughout the program progress since Myanmar is mainly rely on agriculture practice.

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CHAPTER TWO

IMPACT OF COMMUNITY NUTRITION PROJECT ON CHILD HEALTH: A CASE STUDY OF SPRING-GHANA PROJECT – A 1,000-DAY HOUSEHOLD APPROACH

2.1 Introduction

This study aims to estimate the effect of community nutrition project on child health such as stunting, acute malnutrition and underweight among children who are less than five years of age.

Nutritional deficiencies can compromise the immune system that makes one more vulnerable to sickness and diseases, become more severe, chronic, and less responsive to treatment than their counterparts not nutritionally deprived. Poor nutrition in the early life poses a high risk of physical illness, developmental challenges, and cognitive functioning problems as compared to children who had good nutritional needs in their early years. Every child is entitled to good nutritional needs which is necessary for normal growth and development. However, many children in developing countries are unable to obtain the nutritional needs required for normal bodily growth. Evidence has shown that lacking of nutrition in childhood have long-run impact on health status as well as on labor market and educational achievement. The negative effects happens to be higher for individuals subjected to nutrition deprivation in utero or within 2 years of life (*Bryce et al., 2008*). The study by Alderman et al., (2006) revealed that two years of child's life is the most essential duration for investments in child nutrition.

Neelsen and Stratmann (2011) find that undernutrition in infants and in fetal undernourishment damages the development of human capital in the long term. Their study revealed that exposure to famine at a tender age decreases literacy probability and the likelihood of secondary schooling and years of education. Meng and Qian (2009) studied that fetus expose to famine in China(1959–1956) appreciably were shorter in adulthood and lesser educational achievement. The study revealed that children aged 12 to 24 months who were malnourished lost height by 4.6 cm at adolescence. Jamison, (1986) finds that poor nutritional status (height-for-age) adversely affect children educational performance, the study revealed that a SD decline in height-for-age, points to a child has been about one-third of a one year further behind their counterparts. (Moock & Leslie, 1986) checks the association between nutritional condition of children and schooling attendance. The paper showed that nutritional

situation (height-for-age) is an essential determinant of school enrollment and grade completion.

There exists mixed clue on the effect of nutrition projects or program interventions on child health. For instance, Darmstadt et al., (2005) showed breast feeding as one of the cost effective intervention strategies that could avert 55 to 87 percent of neonatal death. Bhutta et al., (2008) revealed that nutrition programs alone is not adequate to reduce stunting or probability of underweight but can be reduced with the improvement of determinants of malnutrition such as poverty and disease burden. Evaluating the effect of a Nutrition Program aimed at improving child nutrition in Senegal, Linnemayr & Alderman, (2011) posited that the program had impact on weight-for-age for the youngest children but no strong impact based on planned treatment status.

Spring/Ghana introduced a community nutrition project in 2014, a "1,000-day household approach" strategy in the two regions of Ghana such as Upper east and Northern regions, which ended in December 2017. The project focused was on essential specific and sensitive nutrition behaviors aiming at the determinants of malnutrition. The aim of the project was to improve the health of households which have children under two years old of age and pregnant women. The project objective was to reduce chronic malnutrition (stunting) within 1000 days a child life, that is from conception to two years after birth by 20 percent, as well as reduce anemia in both in under-fives and women age 15 to 49 of age. Although the nature of the project introduction is a natural experiment, there is no empirical study that examines the program's causal effect on child health. Consequently, we study the impact of the project on stunting, acute malnutrition and underweight among children who are under 5 years of age in the survey year.

This study adds to the available literature on the community nutrition program's effect on child health. This is the first paper that studies the project effect on child health using the difference-in-difference approach. And this study finds that policy significantly reduces the probability of Low height-for-age (stunting) and low weight-for-age (underweight) by 9 and 9 percentage points respectively among children who are under 5 years old age in the treatment regions compared to control regions. However, we do not find the project effect on the low weight for height (acute malunion). The rest of the charters are as follow. Section 2.1 presents introduction and provides the background of the program and nutritional status in Ghana. Section 2.2 presents the data description about all the variables. Section 2.3 presents empirical

strategy applying difference-in-difference strategy between treatment and control regions across the year. Section 2.4 presents the main results of the analysis, parallel trend assumption, and also provides robustness checks and heterogeneous analysis. And section 2.5 concludes the paper.

2.1.1 Background

The 2014 demographic and health survey, Ghana report show that about 33 percent of under 5 years old age in the Northern part of Ghana are stunted comparative to 10 percent stunting in the region, greater Accra, with the rates of malnutrition as high as 20 percent among children who are under 5 years of age in the northern region of the country. Although national stunting rates have declined since 2008, the stunting rates in the Northern region show a rise from 32 in 2008 to 33 percent in 2014.

In order to address the above issues, Spring Ghana introduced a "1,000-day household approach" strategy in 2014. The approach centered on specific and sensitive nutrition household behaviors aiming at the determinants of malnutrition. The aim of spring Ghana was to improve the health of households which have pregnant women and children below two years within thousand days. SPRING relied on evidence-based practices to develop a multi-sectoral strategy to reduce stunting and anemia in the two regions of Ghana: Northern region and Upper East region. The activities of the project are as follow.

Nutrition: Infant and Young Child Feeding concentrates on breastfeeding's initiation early; restricted breastfeeding within the first six months; and went on BF for two years; timely, appropriate interdependently feeding- including orangefleshed sweet potatoes. Procurement of nutrition commodities such as water purification tablets, ZinCfant 20 mg, Vitamin A, Ferrous sulphate and equipment for health facilities within the SPRING Districts prevent shortage. 1,528 health staff were trained in more than 280 health facilities for correct monitoring of child growth over time, particular attention was paid on accurate round out of growth charts to aid in identifying directions and give counseling to mothers and caregivers.

Agriculture: Spring worked with farmers of 1000 day households to reduce exposure to aflatoxins in groundnuts, but also deliver information on other nutrient-rich crops. SPRING encouraged to cultivate the orange-fleshed sweet potatoes and maize enriched in vitamin A, an effort to reduce micronutrient deficiencies. They supplied vitamin A maize seeds for cultivation to Mother-to-mother support groups (MTMSGs) which reveals a connection for caregivers to share among them (peers to peers) regarding the adoption of better nutrition

practices. The project manufactured safe and nutritious foods in collaboration with project peanut butter.

Behavior change communication (BCC) approach: Advocate for the consumption of animal food sources by young children; clean play spaces that are free of human and animal feces for children; handwashing with soap and latrine use.

Quality improvement: Formed quality improvement teams that conducted random audits on child health record books to simplify accurate rounding of growth charts. The project implemented village savings and loan associations in 49 communities to enable them organize funds for health care activities, nutritious foods, or agricultural inputs.

SPRING project also introduced nutrition counselling services in both the health facilities and at the community levels to help increase the quality on Infant and Young Child Feeding. Spring created a comprehensive training curriculum for anemia which was used to build health workers and community health volunteers capacity on anemia determinants, strategies and current treatment protocols. The training improved the expertise of the clinical staff in the detection, diagnoses and treatment of anemia and infections especially in children under five and pregnant women, as well as the skills of community health volunteer in the detection anemia and nutrients rich measures of anemia.

Although their main objective was to reduce stunting within 1000 days of the child alive from conception to second day of birth, but strategies covers the under-five, women of reproductive age the entire populace as well. As such this study seeks to explore the project effect on malnutrition among children who are less than 5 years old of age measured by stunting, so called low-height-for-age, acute malnutrition, so called low-weight-for-height and underweight, so called low-height-for-age.

2.2 Data description

We use the Ghana Multiple Indicator Cluster Survey (MIC) to estimate the project effect on malnutrition. There are three waves of the data set, that is wave 2006, 2011 and 2017 waves. The data collection was started on 15th October 2017 and ended on 15th January, 2018. We use 2017 and 2011 data sets for analysis of our main results. The survey reveals vital information on the health of women, and children in Ghana. Women age 15-49 who permanently reside in the identified households or visitors who had stayed a night prior to the survey in the identified households which were eligible for the interview. The women

questionnaires were used to get information on children health status; including children's weight and height, which is used to measure children nutrition status. The dataset contains complete information on child height for age, weight for age, and weight for height which we use to create our dependent variables of interest – stunting, underweight and acute malnutrition.

Table 2.1 describes summary statistics of the main dependent variables for the study. It presents the main the dependent variables of interest and as well as the control variables. The outcomes are low-weight-for-height (acute malnutrition), low-height-for-age (stunting), and low-weight-for-age (underweight) which has a mean percentage of 7.2, 22 and 15 respectively. There is no wide gender gap in our data set, the mean percentage of males are 50.5 and females being 49.5. Most of the respondents are from the poorest and poorer (39.9 and 20 percent respectively) households and of rural (67.2 percent) dwellers.

Table 2.1 Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Low-weight-for-height	75,059	0.072	0.259	0	1
Low-height-for-age	74,735	0.221	0.415	0	1
Low-weight-for-age	74,819	0.150	0.357	0	1
Treatment	34,807	0.704	0.456	0	1
Post (2017 & 2018)	76,581	0.533	0.499	0	1
Sex:					
Male	76,581	0.505	0.500	0	1
Female	76,581	0.495	0.500	0	1
Place of residence					
Urban	76,581	0.328	0.469	0	1
Rural	76,581	0.672	0.469	0	1
Mother education	76,581	1.490	1.099	0	4
Order of Birth	72,371	2.010	0.875	1	4
Poorest	76,284	0.399	0.490	0	1
Poorer	76,284	0.201	0.401	0	1
Middle wealth	76,284	0.157	0.364	0	1
Richer	76,284	0.131	0.337	0	1
Richest	76,284	0.112	0.316	0	1
Mother age					
Mother age (14-19)	73,199	0.128	0.334	0	1
Mother age (20-24)	73,199	0.143	0.350	0	1

Mother age (25-29)	73,199	0.171	0.376	0	1
Mother age (30-34)	73,199	0.195	0.396	0	1
Mother age (35-39)	73,199	0.176	0.381	0	1
Mother age (40-44)	73,199	0.114	0.318	0	1
Mother age 45-49	73,199	0.074	0.262	0	1
Mother marital status					
Currently married	73,538	0.765	0.424	0	1
Formerly married	73,538	0.055	0.227	0	1
Never married	73,538	0.181	0.385	0	1
Household head Ethnicity	76,552	20.061	17.884	11	96
Household age	39,834	47.601	14.417	15	98
Household head religion:					
No religion	76,480	0.053	0.224	0	1
Christian	70,405	0.741	0.438	0	1
Muslim	76,480	0.044	0.205	0	1
Traditional	76,480	0.218	0.413	0	1
Other religion	76,480	0.002	0.045	0	1

Note: The main dependent variables of child health outcomes: low-weight-for-height, low-height-for-age and low-weight-for-age, which are measured in z-score in the Ghana Multiple Indicator Cluster Survey (MIC) dataset in each variable, specified based on WHO (World Health Organization) standard.

2.3 Estimation strategy

The Spring Ghana project was implemented in the two regions of Ghana: Northern and the Upper East regions, started in 2014 and ended in December 2017. The nature of the implementation of the project offer us the opportunity to estimate causal effect. We can rely on the variation of the project implementation to estimate the program impact using the difference-in-difference approach. We estimate program effect using the regions that benefited from the implementation (Upper East and Northern region) as treatment regions and the comparison group being the regions that did not receive the program. We use the Ghana multiple indicator survey data set 2017 and 2011 to estimate the project effect on malnutrition.

Model,

$$Y_{ijt} = \beta_0 + \beta_1 Treat_j + \beta_2 Post_t + \delta Treat_{ij} * Post_t + \beta_3 X'_{ijt} + T_j + \mathcal{E}_{ijt}$$

Y_{ijt} represents child health indicators measured as stunting, acute malnutrition and underweight. $Treat_{ij}$ takes the value of 1 if regions are the Northern and Upper east regions

and 0 is if Greater Accra and Volta. $Post_t$ represents 1 if survey year is 2017 and 2018 and 0 otherwise if 2011. $Treat_{ij} * Post_t$ is the interaction term of treatment and post. δ measures the program impact. X'_{ijt} represents vector of independent variables. The independent variables include child age, child gender and order of birth; mothers' education, age and marital status; household age and education, ethnicity and religion of household head; place of residence and wealth index. T_j represents regional fixed effect. $\mathcal{E}_{ijt}$ represents the error term clustered at the primary sampling unit[1].

2.4 Empirical results

We report the estimates of our study on the effect of the community nutrition program on child malnutrition in table 2.2, 2.3 and 2.4 respectively.

Table 2.2 Effect of the project on stunting (Low height-for-age)

VARIABLES	(1) Low-height-for-age	(2) Severe low-height-for-age	(3) Moderate low-height- for-age
Treat	0.01	0.02	-0.01
	(0.05)	(0.03)	(0.04)
Post	0.00	0.03*	-0.03
	(0.03)	(0.02)	(0.02)
Treat*Post	-0.09**	-0.09***	0.00
	(0.04)	(0.03)	(0.03)
Constant	0.27***	0.13**	0.13**
	(0.09)	(0.06)	(0.06)
Observations	13,751	13,751	13,751
R-squared	0.08	0.04	0.05

Note: This table reports the effects of the spring project on (low-height-for-age) stunting among children who are less than 5 years old of age. The project is the interaction of treatment and post (year 2017 and 2018). We control for the following all the columns: child's age and gender; mother age, education and place of residence (rural); household head age, gender, education, ethnicity, wealth index and religion. Variance cluster robust standard errors are reported in each parenthesis. The error term is clustered at the primary sampling unit. Statistical significance is *** 1%, **5 % and *10%.

[1] The total sample size was allocated to each of the ten regions, which follows the same as allocation the GDHS(Ghana Demographic Household Survey) 2003. Therefore, the allocation in each region contains a minimum of 25 clusters, and the final sample size calculated at 6,300 households and 300 clusters in total. The clusters (primary sampling units) were distributed to urban and rural domains in each region, and proportional to the size of urban and rural populations in that region.

Table 2.2 shows the effect of the project on stunting and its sub-categories. Column 1 is stunting, and column two and three are sub-categories of stunting in the case of severe and moderate. In column 1, the results show that project significantly reduces stunting. That is holding all other covariates constant the project reduces the probability of (low-height-for - age) stunting by 9 percentage points at 5 percent significant level. In column 2, the project strongly reduces the probability of severe low height for age by 9 percentage points, and in column 4, the policy has no effect on the moderate low height for age.

Table 2.3 Effect of the project on underweight: Low-weight-for-age

VARIABLES	(1) Low-weight-for-age	(2) Severe low-weigh-for-age full	(3) Moderate low-weight-for-age
Treatment	0.07	0.00	0.06*
	(0.04)	(0.02)	(0.03)
Post	0.04**	0.02*	0.02
	(0.02)	(0.01)	(0.02)
Treatment*Post	-0.09***	-0.04***	-0.05
	(0.03)	(0.01)	(0.03)
Constant	0.00	0.12***	-0.11
	(0.08)	(0.04)	(0.08)
Observations	13,818	13,818	13,818
R-squared	0.05	0.02	0.03

Note: This table reports the effects of the spring project on underweight among children who are less than 5 years old of age. The project is the interaction of treatment and post (year 2017 and 2018). We control for the following all the columns: child's age, child gender; mother age, education and place of residence (rural); household head age, gender education ethnicity, wealth index and religion. Variance cluster robust standard errors are reported in each parenthesis. The error term is clustered at the primary sampling unit. Statistical significance is *** 1%, **5 % and *10%.

In table 2.3, we also present the results of the project effect on underweight children (low-weight-for-age). Column 1 is the effect of the project on low-weight-for-age. The results show that the project, holding all other covariates constant significantly reduces the probability of low weight-for-age by 9 percentage points. In a randomized trial that evaluates the effect of school feeding program by Kazianga et al., (2009) on health and education for children from poor background in Burkina Faso, where student are provided with lunch and girls provided with take home rations reveals an increase in weight-for-age, which is consistent with our

findings. With the categories of underweight, in column 2, the project significantly reduces the probability of severe low weight-for-age by 4 percentage points, and moderate low weight-for-age by 5 percentage points in column 3.

Table 2.4 Effect of the project on acute malnutrition: low-weight-for-height

VARIABLES	(1) Low-weight-for-height	(2) Severe low-weight-for-height	(3) Moderate low-weight-for-height
Treatment	0.03	0.00	0.03
	(0.03)	(0.01)	(0.03)
Post	0.00	-0.00	0.01
	(0.02)	(0.01)	(0.01)
Treatment*Post	-0.01	0.01	-0.01
	(0.02)	(0.01)	(0.02)
Constant	0.11**	0.05**	0.06
	(0.06)	(0.02)	(0.05)
Observations	13,888	13,888	13,888
R-squared	0.02	0.02	0.02

Note: This table reports the effects of the spring project on acute malnutrition among children who are less than 5 years old of age. The project is the interaction of treatment and post (year 2017 and 2018). We control for the following all the columns: child's age, child gender; mother age, education and place of residence (rural); household head age, sex education ethnicity, wealth index and religion. Variance cluster robust standard errors are reported in each parenthesis. The error term is clustered at the primary sampling unit. Statistical significance is *** 1%, **5 % and *10%.

Table 2.4 reports the project effect on acute malnutrition, so called low-weight-for-height. The results show that there is a reduction on the probability of severe acute malnutrition; however, the coefficients are not statistically significant.

Table 2.5 Effect of the project on malnutrition - Parallel trend

VARIABLES	(1) Low height-for-age	(3) Low-weight-for-age	(2) Low-weight-for-height
Post	-0.26	0.04	-0.24
	(0.19)	(0.03)	(0.17)
Treatment	-0.11	0.37	0.19
	(0.41)	(0.39)	(0.42)

Treatment*Post	0.15	-0.32	-0.17
	(0.41)	(0.39)	(0.42)
Constant	0.61***	0.09	0.34*
	(0.21)	(0.10)	(0.18)
Observations m.	16,096	16,212	16,214
R-squared	0.05	0.04	0.02

Note: This table reports the effects of the spring project on acute malnutrition among children. The periods are 2013 and 2015. "Post" refers a dummy indicator which takes 1 value for 2011 and 0 for 2006. The project is the interaction of treatment and post (year 2011). We control for the following all the columns: child's age, child gender; mother age, education and place of residence (rural); household head age, gender, education ethnicity, wealth index and religion. Variance cluster robust standard errors are reported in each parenthesis. The error term is clustered at the primary sampling unit. Statistical significance is *** 1%, **5 % and *10%.

To ensure that the estimates are valid, we use the 2006 and 2011 data set to estimate the assumption for a parallel trend equation for the main analysis. Table 2.5 presents the results of the parallel trend assumption. Our results in all the columns are statistically insignificant denoting that was a common trend for stunting or chronic malnutrition (low-height-for-age), underweight (low-weight-for-age) and acute malnutrition (low-weight-for-height) in both treatment and control regions before the project implementation.

2.4.1 Robustness Check

To improve the precision of the estimated effects, we check robustness estimator by the logistic regressions for binary outcomes to examine the parameters in case of outliers or influential observations. Kordzakhia, N., Mishra, G. D., & Reiersølmoen, L. (2001) brought in a robust logistic estimation in case of minimizing the mean-squared deviance for the worst-case contamination. Timmerman et al. used the logistic estimation analysis to identify between benign and malignant adnexal mass before surgery. Merritt et al. applied the binary logistic regression to explore the role of dairy food intake and risk of ovarian cancer.

Table 2.6 presents the robustness check of child health outcomes using logistic regression since the outcomes are binary data. The results show that the project have a marginal effect reduction on stunting (low-height-for-age) by 7.8 compared to those without project after holding all control variables in column 1, the project also have a marginal effect reduction on underweight (low-weight-for-age) by 10 related to those in the control regions controlling all other covariate variables in column 2, and the project only have a negative relationship on acute

malnutrition (low-weight-for-height). As expected, the results in the robustness check are compatible with the main results in table 2.2, 2.3, and 2.4 respectively.

Table 2.6 Child Health by logistic regression

VARIABLES	(1) Low-height-for-age	(2) Low-weight-for age	(3) Low-weight-for height
Treat	0.05	0.37*	0.30
	(0.18)	(0.19)	(0.21)
Post	0.00	0.25**	0.06
	(0.12)	(0.13)	(0.13)
Treat*Post	-0.078*	-0.10***	-0.01
	(.043)	(0.04)	(0.02)
Constant	-0.68**	-1.80***	-1.43***
	(0.30)	(0.34)	(0.40)
Observations	13,751	13,818	13,862

Note: This table reports the robustness check of the spring project on stunting, underweight and acute malnutrition among children who are less than 5 years of age. The project is the interaction of treatment and post (year 2017 and 2018). We control for the following all the columns: child's age, child gender; mother age, education and place of residence (rural); household head age, sex education ethnicity, wealth index and religion. Variance cluster robust standard errors are reported in each parenthesis. The error term is clustered at the primary sampling unit. Statistical significance is *** 1%, **5 % and *10%.

2.4.2 Heterogenous Analysis

The project effect can differ by wealth and it may be the interest of policy makers to know the categories of people that were the most affected by the project to aid in future policy designs. We, therefore, analyze the project effect by wealth indexes. Table 2.7 presents results of the heterogeneous analysis by wealth indexes. In Panel A, we report effect of the project among the poorer and the poorest. The project significantly reduces low-height-for-age and low-weight-for-age among the children who are under five years old of age in households in the bottom-two wealth quintiles by 15 and 11 percentage points respectively. However, in panel B, we find no effect on among children who are under five years old of age with stunting or chronic malnutrition (low-height-for-age), underweight (low-weight-for-age) and acute malnutrition (low-weight-for-height) across the richer and the richest.

Table 2.7 Effect of the project by wealth indexes

VARIABLES	(1) Low height-for-age	(2) Low weight for age	(3) Low weight for height
Panel A: Bottom 2 quintiles			
Treatment	-0.09	0.07	0.01
	(0.11)	(0.08)	(0.07)
Post	0.03	0.03	-0.01
	(0.05)	(0.04)	(0.04)
Treatment*Post	-0.15**	-0.11**	0.00
	(0.07)	(0.06)	(0.04)
Constant	0.32**	-0.00	0.15
	(0.16)	(0.13)	(0.12)
Observations	8,140	8,163	8,214
R-squared	0.10	0.09	0.05
Panel B: Top 2 quintiles			
Treatment	-0.05	-0.08	-0.01
	(0.07)	(0.06)	(0.04)
Post	-0.04	0.00	0.02
	(0.03)	(0.02)	(0.02)
Treatment*Post	0.06	0.04	0.01
	(0.06)	(0.06)	(0.04)
Constant	0.44***	0.18	0.02
	(0.16)	(0.15)	(0.09)
Observations	3,550	3,578	3,571
R-squared	0.09	0.07	0.04

Note: This table reports the effects of the spring project on acute malnutrition among less than 5 years. The project is the interaction of treatment and post (year 2017 and 2018). Panel A is the project impact among the bottom 2 quintiles (Poor & Poorest) and Panel B is among the top 2 quintiles (richer and richest). We control for the following in all the columns: child's age, child gender; mother age, education and place of residence (rural); household head age, gender, education ethnicity and religion. Variance cluster robust standard errors are reported in each parenthesis. The error term is clustered at the primary sampling unit. Statistical significance is *** 1%, **5 % and *10%.

2.5 Conclusions

We study the effect of the community nutrition project-Spring/Ghana on stunting, acute malnutrition and underweight among children who are under-five years of age using the multiple indicator cluster survey and applying the difference-in-difference estimator. Our results show that the policy significantly reduces the probability of low-height-for-age and low-weight-for-age by 9 and 9 percentage points respectively among children under 5 years old of age in the treatment region. However, we did not find the project effect on the low weight for height. We also investigate the project effect on the categories on low height for-age, low-weight-for-age and low-weight-for-height. Our results reveal that the project is significant in reducing severe low height-for-age (stunting) and severe low weight-for-age (underweight) than in both moderate low height-for-age (stunting) and moderate low weight-for-age (underweight). The results from the robustness check are consistent with the main results. The parallel trend assumption we show confirms the validity of our results.

We recommend the implementation on community nutrition programs such as the Spring Ghana programs in stunting and underweight endemic areas to aid in the reducing stunting and underweight. We also recommend the integration of the Spring Ghana into the Ghana health nutrition policy to ensure continuity of the interventions even after spring exit.

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CHAPTER THREE

INTERGENERATIONAL IMPACTS OF EDUCATION ON CHILDHOOD NUTRITION: EVIDENCE FROM VIETNAM

3.1 Introduction

This study exploits an ideal natural experiment that increased the completing primary school of mother in Viet Nam by implementing the Law on Universal Primary Education (LUPE) in Vietnam in 1991 to analyze the causal impact of maternal education on under-five year age of child mortality rate, under one-year age of infant mortality rate and child nutritional status: stunting (low height for age), (underweight) low weight for age and (acute malnutrition) low weight for height, under 5 year of child mortality rate and under one year of infant mortality rate among under five years old of children across six regions in Viet Nam in the survey year of 2011.

Childhood is the early step of human's life correlated with growth and development. The growth continues rapidly in early life, slows down in middle childhood and accelerates at adolescence prior the growth stage. Sufficient nutrition is important for growth, health and development of under-five years of age of children. Inadequate nutrition increases the risk of illness and diseases, become more harsh, chronic, and less responsive to treatment compared to their counterparts which are not impoverished in nutrition. Lacking sufficient nutrition in the early life leads a high risk of physical illness, developmental challenges, and cognitive functioning difficulties than the children who had enough nutritional supports in their early lives. Every child is supposed to have a adequate nutritional requirements, which is essential ones for the usual progress development and growth in children who are under 5 years old of age. And nutritional deficiencies in childhood leads to the loss of developmental and academic achievement and contributes to long-term impact on health and disparities in economy in under five-year age of children, and have long-run impact on health status as well as on labor market and educational performance. Furthermore, early child development outcomes have been positively connected by the early supplying of absolute nutrition and good conditions for learning. Alderman et al., (2006) shows that investments in child nutrition is the most significant period for 2 years old of child's life. The providing the optimal feeding practices for children and infant depends upon the knowledge quality of caregivers, typically parents, are the most distinct determinant that drives child's survival, health, growth, and development.

Caldwell (1979), and Barrera (1990) releveled that higher education of women also led to have a higher knowledge in contemporary health care activities and higher capability to interact with providers of health care.

The study by Ki-moon (2010), and Veneman (2007) mentioned that on the role of parental education, particularly maternal schooling was meant for being the important key of child health care policies. Applying the identical reform, Ali and Gurmu (2016) estimated the impact of female schooling on fertility outcomes. Some previous studies did research the impact parents' education on children health outcomes (Lindeboom, Llena-Nozal, & van der Klaauw, 2009; McCrary & Royer, 2011) but there is a contradiction with other research studies, particularly on mother schooling and children health outcomes (Breierova & Duflo, 2004; Chou, Liu, Grossman, & Joyce, 2010; Currie & Moretti, 2003).

This study utilizes a nationwide implemented compulsory primary school completed reform, so called Law on Universal Primary Education (LUPE) in 1991 in Vietnam to classify the impact of mother education on child health outcomes, infant and child health. In 1991, Viet Nam introduced LUPE (Law on Universal Primary Education) that gives more opportunities for children to initiate the schooling, minimum at the primary school level (grade 5). According to the LUPE in Viet Nam, for all children at the 6 years old of age must be in the first grade (grade 1) and at the maximum of 14 years old of age must accomplish the last grade (grade 5) of the primary schooling level in 1991.

The variation in the compulsory primary schooling reform contributes an ideal natural experiment, where those women binded by this reform were forced to attain more education than before. Relying on this policy reform, this study extracts exogenous changes in parental schooling to research the impact of mother educational level on infant health and child health outcomes. Breierova and Duflo (2004), in Indonesia, using a large-scale school construction program, researched that parent education largely decreases infant mortality rate. In Taiwan, Chou et al. (2010) studied the compulsory schooling expansion in 1968, where parent education decreases the likelihood of low birth weight and child mortality rate. In Zimbabwe, Grépin and Bharadwaj (2015) estimated that mother education decreases child mortality rate, increases the chance on economic activities for women, and improves the childbearing age.

This study is organized in five sections. Section 3.1 presents introduction and background about child health and the educational reform in Viet Nam. Section 3.2 shows data description. Section 3.3 presents the empirical strategy applying a simple ordinary least square regression from educational reform in Viet Nam in 1991. Section 3.4 probes the main results and robustness checks. And section 3.5 concludes this study.

3.1.1 Background

Before the Law on Universal Primary Education (LUPE) was implement in 1991, educational assessments were not available in all Vietnamese children due to poverty and lack of resources mainly in rural and remote areas. Therefore, the educational law has been noted as a vital policy to increase education attainment among all Vietnamese people throughout the whole country. According to the Law on Universal Primary Education (LUPE) in Viet Nam, 6 years old of all children must be in the grade 1 and maximum 14 years old age of all children must complete the grade 5, the last grade in the primary level. Before the reform, Vietnamese all children in Viet Nam were not mandatory to participate at any level of schools. Getting education individually was only depended up their family's own decision. Due to the Law on Universal Primary Education (LUPE) in Viet Nam, compulsory schooling years were changed from 0 to 5 years.

Moreover, the Law on Universal Primary Education (LUPE) mainly focused on children in rural and isolated areas, where schooling rate is lesser than in urban areas. The LUPE's implementation improved educational attainment in all areas in Vietnam. For instance, the primary school enrollment rate was nearly 8.1 million in 1986 and 8.7 million in 1989, and 9.1 million in 1992 and 10 million in 1995. In 2000, almost 14 years age of all children completed primary education level. The LUPE in 1991 is obviously beneficial as a cutting conversion which points out a discontinuous alteration in educational level of Vietnamese people at the maximum 14 years of age in 1991 and must be finished the primary school level (grade 5). The discontinuity is utilized to construct the exogeneous variation treatment groups to analyze the causal impact of mother education on children nutritional outcome-stunting, underweight and acute malnutrition, child mortality and infant mortality rate.

In the MICS survey year 2011 in Viet Nam, the under 5-year age of child mortality rate have 16 per 1,000 births alive and less than 1-year age of infant mortality rate have 14 per 1,000 births alive. In nutritional status, weight-for-age malnourished (underweight) children is 11.7 percent, height-for-age malnourished (stunted) children is 22.7 percent, and weight-for-height malnourished (wasted) children is 4.1 percent. There is a substantial disparity along the length of ethnicity, place of birth (urban and rural), wealth quintiles and living standards, and by mother's education level.

3.2 Data description

This study uses the Viet Nam Multiple Indicator Cluster Survey (MICS) to estimate the impact of maternal education on child health nutritional outcomes using year of birth of mother (born ≥ 1980), which is exploited from the Law on Universal Primary Education (LUPE) in Vietnam in 1991. The data collection was started from 2010 to 2011 under the General Statistics Office of Viet Nam. We use MICS 2011 data set for analysis of our main results. The survey covered a wide range of issues and provides vital informations affecting health, development and living conditions of children and women in six regions of Vietnam. The women questionnaires were used to get information on child (under-five years old of age) health stratus; including weight and height, which is used to measure children nutrition status. The data set contains complete information on child nutritional status: stunting, underweight and acute malnutrition which we use to create our dependent variables of interest– stunting, underweight and acute malnutrition, and under-5 year age of child mortality rate in 1,000 births alive and under 1 year old age of infant mortality rate of children in 1,000 live births.

Table 3.1 describes the summary statistics of the dependent variables in this analysis. It presents main dependent variables of interest and as well as the control variables. The outcomes are low height for age which is stunting, low weight for age which is underweight and low weight for height which is acute malnutrition, under-five year of child mortality and under-one year of infant mortality which has a mean percentage of 14.1, 11.2, 6.5, 47 and 3.9 respectively. There is no much wide gender gap in our data set, the mean percentage of males are 53 and females being 47. Most of the respondents are from the richer and richest (20 and 21.8 percent respectively) households and of rural and urban (56.2 and 43.8 percent respectively). And 90.1 percent of respondents' own dwellings and most own higher household ownerships of electricity, television, mobile phone and motorcycle (98.8, 91.4, 86.3 and 81.8 percent respectively). The summary statistics is reported by detailing in table 3.1 below.

Table 3.1 Summary statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Low height for age	11452	.141	.348	0	1
Low weight for age	11452	.112	.315	0	1
Low height for height	11452	.065	.246	0	1
Child Mortality (<5-year-old age)	11663	.047	.212	0	1
Infant Mortality (<1-year old age)	11563	.039	.194	0	1
Mother education					

None	12,113	.050	.217	0	1
Primary	12,113	.193	.395	0	1
Lower secondary	12,113	.375	.484	0	1
Upper secondary	12,113	.189	.391	0	1
College/University	12,113	.193	.395	0	1
Gender					
Male	12115	.53	.499	0	1
Female	12115	.47	.499	0	1
Mother Age	11663	31.476	9.944	15	49
HH head education					
None	14535	.067	.249	0	1
Primary level	14535	.247	.431	0	1
Lower secondary level	14535	.373	.484	0	1
Upper secondary level	14535	.176	.381	0	1
College/University level	14535	.138	.345	0	1
Place of residence					
Urban area	14842	.438	.496	0	1
Rural area	14842	.562	.496	0	1
Regions					
Red river delta	14842	.157	.364	0	1
Northern midlands and Mountain area	14842	.166	.372	0	1
North central and central Coastal area	14842	.165	.372	0	1
Central highlands	14842	.17	.376	0	1
South east	14842	.174	.379	0	1
Mekong river delta	14842	.168	.374	0	1
Wealth Index Quintiles					
None	14842	.048	.214	0	1
Poorest	14842	.183	.387	0	1
Poorer	14842	.165	.372	0	1
Middle wealth	14842	.183	.387	0	1
Richer	14842	.202	.402	0	1
Richest	14842	.218	.413	0	1
HH owns dwelling					
Own	14565	.901	.299	0	1
Rent	14565	.051	.22	0	1
Other	14565	.048	.215	0	1
Household ownerships					
Electricity	14573	.988	.107	0	1
Television	12020	.914	.281	0	1
Mobile phone	14573	.863	.344	0	1
Motorcycle	14573	.818	.386	0	1
Survey year = 2010	14842	.667	.471	0	1
Survey year = 2011	14842	.333	.471	0	1

Note: Child health outcomes: Low height for age which is stunting, Low weight for age which is underweight, Low weight for height which is acute malnutrition, measured in z-score which is calculated in the survey of MICS 2011 Viet Nam data set.

Table 3.2 Tabulation of year of birth of mother and mother educational level

YOB of Mother	Mother's education level				
	None	Primary	Lower Secondary	Upper Secondary	Tertiary/ University
1969	13	64	138	49	61
1970	19	81	138	64	56
1971	13	67	121	53	65
1972	17	60	95	60	81
1973	20	68	106	54	59
1974	17	45	115	54	54
1975	24	74	108	73	62
1976	15	57	122	63	60
1977	16	73	121	73	73
1978	7	51	117	59	68
1979	9	63	117	57	52
1980	14	54	130	60	66
1981	15	51	108	55	61
1982	12	62	126	70	68
1983	9	53	97	50	61
1984	15	46	100	55	50
1985	10	45	83	33	39
1986	6	35	64	43	30
1987	10	35	58	33	35
1988	6	16	49	28	18
1989	4	17	29	23	14
1990	4	13	20	11	18
1991	1	6	15	8	9

Note: In the variable of year of birth of mother from 1969 to 1991, mothers are restricted only ever born child.

Table 3.2 reports the tabulation of year of birth of mother and maternal education level. According to the Law on Universal Primary Education (LUPE) in Viet Nam in 1991, 6 years old of all children must be in the grade 1 and maximum 14 years old age of all children must complete the grade 5, the last grade in the primary level. Based on their birth year, those who were born in 1980 and above will be affected by the compulsory primary schooling law. This table shows that there is no much variation in mother schooling levels (example. > primary) between above and below of 1980.

Table 3.3 Tabulation of year of birth of mother and child health conditions, child mortality and infant mortality rates

YOB of Mother	Low Height for Age (Stunting)		Low Weight for Age (Under -weight)		Low Weight for Height (Acute Malnutrition)		Child Mortality		Infant Mortality	
	0	1	0	1	0	1	0	1	0	1
1969	260	46	285	21	277	29	291	34	291	28
1970	267	65	308	26	299	32	327	31	327	24
1971	242	52	278	17	268	26	299	20	299	16
1972	247	39	269	20	261	25	281	32	281	27
1973	234	46	259	22	252	29	283	24	283	22
1974	225	43	248	21	245	24	271	14	271	13
1975	260	64	301	23	295	29	325	16	325	15
1976	245	58	281	24	273	29	308	9	308	7
1977	273	61	315	19	309	24	343	13	343	12
1978	242	46	260	28	252	35	298	5	298	5
1979	228	54	260	23	254	27	291	7	291	6
1980	269	43	292	21	284	28	313	11	313	10
1981	221	56	249	28	248	29	284	6	284	6
1982	266	53	294	25	287	32	328	10	328	10
1983	233	25	244	14	234	24	264	6	264	6
1984	207	40	226	21	218	29	257	9	257	8
1985	169	28	184	13	176	21	201	9	201	6
1986	143	25	156	13	152	17	175	3	175	2
1987	135	30	153	12	151	14	169	2	169	2
1988	86	20	98	8	92	14	117	0	117	0
1989	71	9	70	11	68	12	83	4	83	4
1990	52	12	62	2	60	4	63	3	63	2
1991	32	3	32	3	31	4	39	0	39	0

Note: In the variable of year of birth of mother from 1969 to 1991, mothers are restricted only ever born child. The main variables of child health outcomes: low-weight-for-height, low-height-for-age and low-weight-for-age, which are measured in z-score in the Viet Nam Multiple Indicator Cluster Survey (MIC) dataset in each variable, specified based on WHO (World Health Organization) standard.

Table 3.3 presents the tabulation year of birth of mother and child health outcomes: low height for age, low weight for age and low weight for height, and child mortality and infant mortality rates.

3.3 Empirical strategy

To estimate the impact of mother education on child development conditions: low height for age, low weight for age and low weight for height, child mortality (under 5 year of

age) and infant mortality (0-1 year of age) in the survey year of 2010 and 2011, we use a simple ordinary least squares method exploiting the discontinuous variation from primary school compulsory law in Viet Nam. Due to the LUPE, treatment status is clearly defined by the fact that the running variable is below or above a certain threshold. Meanwhile, compliance of Vietnamese children to the treatment would not be the perfect case in this context since the Viet Nam was a developing country and could face the geographical challenges, basic infrastructures such adequate schools and the like, especially in the remote areas.

Model,

$$Y_{it} = \delta_0 + \delta_1 YOB1980_i + \delta_2 X'_{it} + \delta_t + \varepsilon_{it} \quad (1)$$

$$Y_{it} = \beta_0 + \beta_1 YOB_i + \beta_2 LUPE_1 + \beta_3 LUPE_2 + \beta_4 LUPE_3 + \beta_5 LUPE_4 + \beta_6 LUPE_5 + \beta_7 LUPE_6 + \beta_3 X'_{it} + \delta_t + \varepsilon_{it} \quad (2)$$

Where Y_i indicates child i health outcomes such as stunting, underweight and acute malnutrition, child mortality and infant mortality rates. In equation (1), $YOB1980_i$ takes value 1 if mothers were born in 1980 and 0 if mothers were born in 1979. In equation (2), YOB_i is a year of birth of mother who only ever born child. Each of $LUPE$ is a binary variable specifying whether the mother was born in year 1980 and above till 1985, mathematically $LUPE_1$ = 1(year of birth of mother $\geq$ 1980), $LUPE_2$ = 1(year of birth of mother $\geq$ 1981), $LUPE_3$ = 1(year of birth of mother $\geq$ 1982), $LUPE_4$ = 1(year of birth of mother $\geq$ 1983), $LUPE_5$ = 1(year of birth of mother $\geq$ 1984) and $LUPE_6$ = 1(year of birth of mother $\geq$ 1985), respectively. There was restriction to mother who only ever born children. X'_i represents other control variables such as gender, mother schooling year, father education, area(rural/urban), regions, wealth index quintiles, religion, ethnicity, household ownerships (electricity, television, motorcycle and mobile phone). ε_{it} refers the error term. δ_t denotes survey year *t* (2010 and 2011) fixed effect.

Equation (1) reveals the estimation of compulsory primary schooling law on child health outcomes by making the simple comparison of mothers who were born in the year of 1979 and 1980.

Equation (2) estimates the effect of primary school completion law on child health outcomes by each of $LUPE$ with binary variable specifying whether the mother was born in year 1980 and above till 1985.

3.4 Empirical results

This section probes the results about the maternal education effect on child health nutritional outcomes by utilizing the year of birth of mother as an instrumental variable the compulsory primary school completion law in Vietnam in 1991 as follow: effect of the primary school completion of mothers affected by compulsory schooling law on low height for age (stunting), low weight for age (underweight) and low weight for height (acute malnutrition): mother year of birth (1979 vs 1980) in table 3.4, Effect of primary school completion of mothers affected by compulsory schooling law on child mortality rate and infant mortality rate: mother year of birth (1979 vs 1980) in table 3.5, effect of mother education attainment affected by compulsory schooling law on low height for age (stunting) in table 3.6, effect of mother education attainment affected by compulsory schooling law on low weight for age (underweight) in table 3.7, effect of mother education attainment affected by compulsory schooling law on low weight for height (acute malnutrition) in table 3.8, effect of mother education attainment affected by compulsory schooling law on child mortality rate in table 3.9, and Effect of mother education attainment affected by compulsory schooling law on infant mortality rate in table 4.0.

Table 3.4 Effect of the primary school completion of mothers affected by compulsory schooling law on low height for age (stunting), low weight for age (underweight) and low weight for height (acute malnutrition): mother year of birth (1979 vs 1980)

VARIABLES	(1) Low height for age	(2) Low height for age	(3) Low weight for age	(4) Low weight for age	(5) Low weight for height	(6) Low weight for height
YOB (1980) =1	-0.0552*	-0.0474	-0.00442	-0.00521	0.0102	0.0116
	(0.0287)	(0.0303)	(0.0210)	(0.0215)	(0.0238)	(0.0240)
Female		0.0581*		0.138***		0.118***
		(0.0312)		(0.0246)		(0.0272)
Rural		0.0153		-0.00414		-0.0285
		(0.0401)		(0.0299)		(0.0336)
Household controls		Yes		Yes		Yes
Survey year FE		0.0754**		-0.0492**		-0.0161
		(0.0364)		(0.0223)		(0.0267)
Constant	0.192***	0.171	0.0809***	0.0510	0.0977***	-0.0222
	(0.0210)	(0.136)	(0.0153)	(0.119)	(0.0174)	(0.115)
Observations	660	648	662	650	659	647

R-squared	0.006	0.050	0.000	0.107	0.000	0.075

Note: A robust estimate of the VCE in each regression parentheses. This table reports the estimation of the completion of primary schooling of mother under the Law on Universal Primary Education (LUPE) on height for age (stunting), low weight for age (underweight) and low weight for height (acute malnutrition) by the simple comparison of mothers born in 1979 which is affected by the law and in 1980 which is not under the law. There was restriction to mother who only ever born children. We control for the following all the columns: gender(female), father education, mother age, place of residence (rural), ethnicity, religion, wealth index quintiles, household ownership: dwelling unit, electricity, television mobile phone and motorcycle. Statistical significance is *** 1%, **5 % and *10%.

Table 3.4 probes the effect of the primary school completion of mother affected by compulsory schooling law on low height for age (stunting), low weight for age (underweight) and low weight for height (acute malnutrition) focusing on the comparison of mothers who were born in 1979 which is not affected by the LUPE and in 1980 which is not under the LUPE using equation (1) in the model. The results show that primary school completion of mothers born in 1980 which was under the policy, have an insignificant negative relationship with low height for age (stunting) in column (2) and with low weight for age (underweight) in column (4), and have an insignificant positive with low weight for height (acute malnutrition) compared to mothers born in 1979 which was not affected by the policy.

Table 3.5 Effect of primary school completion of mothers affected by compulsory schooling law on child mortality rate and infant mortality rate: mother year of birth (1979 vs 1980)

VARIABLES	(1) Child Mortality	(2) Child Mortality	(3) Infant Mortality	(4) Infant Mortality
YOB (1980) =1	0.00852	0.00681	0.00888	0.0101
	(0.0122)	(0.0123)	(0.0115)	(0.0118)
Female		0.0131		0.00798
		(0.0129)		(0.0122)
Rural		-0.0163		-0.00874
		(0.0146)		(0.0124)
Household controls		Yes		Yes
Survey year FE		-0.00977		-0.00933
		(0.0141)		(0.0137)
Constant	0.0215**	-0.0407	0.0185**	-0.0600
	(0.00885)	(0.0637)	(0.00838)	(0.0598)

Observations	691	679	689	677
R-squared	0.001	0.059	0.001	0.054

Note: A robust estimate of the VCE in each regression parentheses. This table reports the estimation of the completion of primary schooling of mother under the Law on Universal Primary Education (LUPE) on child mortality rate and infant mortality rate by the simple comparison of mothers born in 1979 which is affected by the law and in 1980 which is not under the law. There was restriction to mother who only ever born children. We control for the following all the columns: gender(female), father education, mother age, place of residence (rural), ethnicity, religion, wealth index quintiles, household ownership: dwelling unit, electricity, television mobile phone and motorcycle. Statistical significance is *** 1%, **5 % and *10%.

Table 3.5 presents the effect of the primary school completion of mother affected by compulsory schooling law on child mortality rate and infant mortality rate focusing on the comparison of mothers who were born in 1979 which is not affected by the LUPE and in 1980 which is not under the LUPE using equation (1) in the model. The results show that primary school completion of mothers born in 1980 which was under the policy, have an insignificant positive with child mortality rate and infant mortality rate compared to mothers born in 1979 which was not affected by the policy.

Table 3.6 Effect of mother education attainment affected by compulsory schooling law on low height for age (stunting)

VARIABLES	(1) Low height for age	(2) Low height for age	(3) Low height for age	(4) Low height for age	(5) Low height for age	(6) Low height for age	(7) Low height for age
Year of Birth of Mother (YOB)	0.000597	0.000464	0.000777	0.000907	0.000624	0.000641	0.000453
	(0.000894)	(0.000909)	(0.000920)	(0.000931)	(0.000939)	(0.000945)	(0.000972)
1(YOB ≥ 1980)	-0.0265*	-0.0410*	-0.0440*	-0.0453*	-0.0425*	-0.0427*	-0.0342
	(0.0153)	(0.0235)	(0.0235)	(0.0236)	(0.0236)	(0.0236)	(0.0226)
1(YOB ≥ 1981)		0.0189	0.0636**	0.0634**	0.0637**	0.0637**	0.0533*
		(0.0232)	(0.0309)	(0.0309)	(0.0309)	(0.0309)	(0.0310)
1(YOB ≥ 1982)			-0.0537**	-0.0369	-0.0366	-0.0367	-0.0326
			(0.0246)	(0.0308)	(0.0308)	(0.0308)	(0.0316)
1(YOB ≥ 1983)				-0.0214	-0.0699**	-0.0699**	-0.0648**
				(0.0236)	(0.0314)	(0.0314)	(0.0280)
1(YOB ≥ 1984)					0.0612**	0.0644*	0.0692**
					(0.0261)	(0.0333)	(0.0304)
1(YOB ≥ 1985)						-0.00421	-0.00739
						(0.0272)	(0.0272)

Female							0.0398***
							(0.00900)
Rural							-0.0128
							(0.0108)
Household controls	No	No	No	No	No	No	Yes
Survey year FE	Yes	Yes	Yes	Yes	Yes	Yes	0.0651***
							(0.0100)
Constant	-1.001	-0.740	-1.356	-1.612	-1.055	-1.088	-0.767
	(1.762)	(1.791)	(1.813)	(1.835)	(1.850)	(1.862)	(1.916)
Observations	7,667	7,667	7,667	7,667	7,667	7,667	7,551
R-squared	0.001	0.001	0.001	0.001	0.002	0.002	0.016

Note: A robust estimate of the VCE in each regression parentheses. This table reports the estimation of the completion of primary schooling of mother under the Law on Universal Primary Education (LUPE) on height for age (stunting), mathematically $LUPE_1$ = 1(year of birth of mother ≥ 1980), $LUPE_2$ = 1(year of birth of mother ≥ 1981), $LUPE_3$ = 1(year of birth of mother ≥ 1982), $LUPE_4$ = 1(year of birth of mother ≥ 1983), $LUPE_5$ = 1(year of birth of mother ≥ 1984) and $LUPE_6$ = 1(year of birth of mother ≥ 1985), respectively. There was restriction to mother who only ever born children. We control for the following all the columns: gender(female), father education, mother age, place of residence (rural), ethnicity, religion, wealth index quintiles, household ownership: dwelling unit, electricity, television mobile phone and motorcycle. Statistical significance is *** 1%, **5 % and *10%.

Table 3.6 repots the effect of mother education attainment affected by compulsory schooling law on low height for age (stunting). Among birth cohorts (1980-1985), mothers who only were born in 1983 mandated to finish grade 3, which reduce the probability of their child health outcome: low height for age (stunting) by 6.5 percentage points in column (7).

Table 3.7 Effect of mother education attainment affected by compulsory schooling law on low weight for age (underweight)

VARIABLES	(1) Low weight for age	(2) Low weight for age	(3) Low weight for age	(4) Low weight for age	(5) Low weight for age	(6) Low weight for age	(7) Low weight for age
Year of Birth of Mother (YOB)	-0.000443	-0.000533	-0.000384	-0.000357	-0.000469	-0.000434	-0.000373
	(0.000633)	(0.000644)	(0.000651)	(0.000659)	(0.000665)	(0.000669)	(0.000690)
1(YOB ≥ 1980)	0.00575	-0.00417	-0.00561	-0.00586	-0.00478	-0.00513	-0.00564
	(0.0109)	(0.0166)	(0.0167)	(0.0167)	(0.0167)	(0.0167)	(0.0157)
1(YOB ≥ 1981)		0.0129	0.0344	0.0343	0.0345	0.0344	0.0382*

		(0.0164)	(0.0219)	(0.0219)	(0.0219)	(0.0219)	(0.0228)
1(YOB ≥ 1982)			-0.0258	-0.0224	-0.0222	-0.0223	-0.0291
			(0.0174)	(0.0218)	(0.0218)	(0.0218)	(0.0235)
1(YOB ≥ 1983)				-0.00434	-0.0236	-0.0237	-0.0196
				(0.0167)	(0.0222)	(0.0222)	(0.0204)
1(YOB ≥ 1984)					0.0243	0.0312	0.0257
					(0.0185)	(0.0236)	(0.0225)
1(YOB ≥ 1985)						-0.00899	-0.000971
						(0.0193)	(0.0199)
Female							0.105***
							(0.00675)
Rural							-0.00727
							(0.00756)
Household controls	No	No	No	No	No	No	Yes
Survey year FE	No	No	No	No	No	No	-0.0174**
							(0.00684)
Constant	0.948	1.127	0.832	0.780	1.001	0.931	0.747
	(1.248)	(1.268)	(1.284)	(1.299)	(1.310)	(1.319)	(1.361)
Observations	7,691	7,691	7,691	7,691	7,691	7,691	7,575
R-squared	0.000	0.000	0.000	0.000	0.001	0.001	0.041

Note: A robust estimate of the VCE in each regression parentheses. This table reports the estimation of the completion of primary schooling of mother under the Law on Universal Primary Education (LUPE) on low weight for age (underweight), mathematically $LUPE_1$ = 1(year of birth of mother ≥ 1980), $LUPE_2$ = 1(year of birth of mother ≥ 1981), $LUPE_3$ = 1(year of birth of mother ≥ 1982), $LUPE_4$ = 1(year of birth of mother ≥ 1983), $LUPE_5$ = 1(year of birth of mother ≥ 1984) and $LUPE_6$ = 1(year of birth of mother ≥ 1985), respectively. There was restriction to mother who only ever born children. We control for the following all the columns: gender(female), father education, mother age, place of residence (rural), ethnicity, religion, wealth index quintiles, household ownership: dwelling unit, electricity, television mobile phone and motorcycle. Statistical significance is *** 1%, **5 % and *10%.

Table 3.7 probes the effect of mother education attainment affected by compulsory schooling law on low weight for age (underweight). Holding household controls and survey year fixed effect in column (7), the results show that mothers who were born in 1980, 1982, 1983 and 1985 have to finish grade 5, grade 3, grade 2 and grade 1 respectively, have a negative relationship with their child health outcome: low weight for age (underweight).

Table 3.8 Effect of mother education attainment affected by compulsory schooling law on low weight for height (acute malnutrition)

VARIABLES	(1) Low weight for height	(2) Low weight for height	(3) Low weight for height	(4) Low weight for height	(5) Low weight for height	(6) Low weight for height	(7) Low weight for height
Year of Birth of Mother (YOB)	-0.00122*	-0.00136*	-0.00138*	-0.00144*	-0.00153**	-0.00150**	-0.00136*
	(0.000720)	(0.000732)	(0.000741)	(0.000750)	(0.000756)	(0.000761)	(0.000792)
1(YOB ≥ 1980)	0.0175	0.00212	0.00238	0.00293	0.00379	0.00345	0.00291
	(0.0123)	(0.0189)	(0.0189)	(0.0190)	(0.0190)	(0.0190)	(0.0181)
1(YOB ≥ 1981)		0.0201	0.0163	0.0164	0.0165	0.0164	0.0180
		(0.0187)	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0244)
1(YOB ≥ 1982)			0.00451	-0.00294	-0.00285	-0.00288	-0.00269
			(0.0198)	(0.0248)	(0.0248)	(0.0248)	(0.0252)
1(YOB ≥ 1983)				0.00949	-0.00576	-0.00579	-0.00611
				(0.0190)	(0.0252)	(0.0252)	(0.0250)
1(YOB ≥ 1984)					0.0192	0.0259	0.0194
					(0.0210)	(0.0268)	(0.0276)
1(YOB ≥ 1985)						-0.00872	-0.00303
						(0.0219)	(0.0234)
Female							0.0498***
							(0.00730)
Rural							0.00218
							(0.00880)
Household controls	No	No	No	No	No	No	Yes
Survey year FE	No	No	No	No	No	No	0.0221***
							(0.00790)
Constant	2.499*	2.776*	2.828*	2.942**	3.117**	3.048**	2.739*
	(1.418)	(1.442)	(1.460)	(1.477)	(1.490)	(1.500)	(1.561)
Observations	7,663	7,663	7,663	7,663	7,663	7,663	7,547
R-squared	0.000	0.001	0.001	0.001	0.001	0.001	0.012

Note: A robust estimate of the VCE in each regression parentheses. This table reports the estimation of the completion of primary schooling of mother under the Law on Universal Primary Education (LUPE) on low weight for height (acute malnutrition), mathematically $LUPE_1$ = 1(year of birth of mother ≥ 1980), $LUPE_2$ = 1(year of birth of mother ≥ 1981), $LUPE_3$ = 1(year of birth of mother ≥ 1982), $LUPE_4$ = 1(year of birth of mother ≥ 1983), $LUPE_5$ = 1(year of birth of mother ≥ 1984) and $LUPE_6$ = 1(year of birth of mother ≥ 1985), respectively. There was restriction to mother who only ever born children. We control for the following all the columns: gender(female), father education, mother age, place of residence (rural), ethnicity, religion, wealth index quintiles, household ownership: dwelling unit, electricity, television mobile phone and motorcycle. Statistical significance is *** 1%, **5 % and *10%.

Table 3.8 describes the effect of mother education attainment affected by compulsory schooling law on low weight for height (acute malnutrition). The results probe that birth cohorts of 1982, 1983 and 1985 born of mothers with completion on grade 3, grade 2, and grade 1, respectively have a negative relationship on their child health outcome: low weight for height (acute malnutrition) holding household controls and survey year fixed effect in column (7).

Table 3.9 Effect of mother education attainment affected by compulsory schooling law on child mortality rate

VARIABLES	(1) Child Mortality	(2) Child Mortality	(3) Child Mortality	(4) Child Mortality	(5) Child Mortality	(6) Child Mortality	(7) Child Mortality
Year of Birth of Mother (YOB)	-0.00677***	-0.00693***	-0.00713***	-0.00728***	-0.00742***	-0.00748***	-0.00765***
	(0.000572)	(0.000582)	(0.000589)	(0.000596)	(0.000600)	(0.000605)	(0.000668)
1(YOB≥1980)	0.0344***	0.0164	0.0184	0.0198	0.0211	0.0217	0.0244**
	(0.00985)	(0.0152)	(0.0152)	(0.0152)	(0.0153)	(0.0153)	(0.0118)
1(YOB≥1981)		0.0234	-0.00613	-0.00598	-0.00584	-0.00578	-0.00704
		(0.0150)	(0.0200)	(0.0200)	(0.0200)	(0.0200)	(0.0129)
1(YOB≥1982)			0.0354**	0.0162	0.0163	0.0164	0.0137
			(0.0158)	(0.0198)	(0.0198)	(0.0198)	(0.0124)
1(YOB≥1983)				0.0244	5.42e-05	0.000116	-0.00143
				(0.0151)	(0.0202)	(0.0202)	(0.0134)
1(YOB≥1984)					0.0306*	0.0191	0.0167
					(0.0168)	(0.0214)	(0.0145)
1(YOB≥1985)						0.0152	0.00341
						(0.0173)	(0.0122)
Female							-0.00383
							(0.00546)
Rural							0.000092
							(0.00675)
Household controls	No	No	No	No	No	No	Yes
Survey year FE	No	No	No	No	No	No	0.00477
							(0.00604)
Constant	13.41***	13.73***	14.13***	14.42***	14.70***	14.82***	15.24***
	(1.128)	(1.146)	(1.160)	(1.174)	(1.183)	(1.191)	(1.320)
Observations	8,179	8,179	8,179	8,179	8,179	8,179	8,055
R-squared	0.028	0.028	0.029	0.029	0.029	0.029	0.057

Note: A robust estimate of the VCE in each regression parentheses. This table reports the estimation of the completion of primary schooling of mother under the Law on Universal Primary Education (LUPE) on child mortality rate, mathematically $LUPE_1$ = 1(year of birth of mother ≥ 1980), $LUPE_2$ = 1(year of birth of mother ≥ 1981), $LUPE_3$ = 1(year of birth of mother ≥ 1982), $LUPE_4$ = 1(year of birth of mother ≥ 1983), $LUPE_5$ = 1(year of birth of mother ≥ 1984) and $LUPE_6$ = 1(year of birth of mother ≥ 1985), respectively. There was restriction to mother who only ever born children. We control for the following all the columns: gender(female), father education, mother age, place of residence (rural), ethnicity, religion, wealth index quintiles, household ownership: dwelling unit, electricity, television mobile phone and motorcycle. Statistical significance is *** 1%, **5 % and *10%.

Table 3.9 presents the effect of mother education attainment affected by compulsory schooling law on child mortality rate. Holding household control variables and survey year fixed effect in column (7), only mothers who were born 1981 and 1983 mandated to accomplish the grade 4, and grade 2 respectively, which have a negative relationship on their child mortality rate.

Table 4.0 Effect of mother education attainment affected by compulsory schooling law on infant mortality rate

VARIABLES	(1) Infant Mortality	(2) Infant Mortality	(3) Infant Mortality	(4) Infant Mortality	(5) Infant Mortality	(6) Infant Mortality	(7) Infant Mortality
Year of Birth of Mother (YOB)	-0.00512***	-0.00523***	-0.00538***	-0.00546***	-0.00555***	-0.00558***	-0.00575***
	(0.000531)	(0.000540)	(0.000546)	(0.000553)	(0.000558)	(0.000562)	(0.000617)
1(YOB≥1980)	0.0238***	0.0117	0.0131	0.0139	0.0147	0.0150	0.0178
	(0.00909)	(0.0140)	(0.0140)	(0.0141)	(0.0141)	(0.0141)	(0.0113)
1(YOB≥1981)		0.0157	-0.00489	-0.00481	-0.00472	-0.00469	-0.00767
		(0.0138)	(0.0184)	(0.0184)	(0.0184)	(0.0184)	(0.0125)
1(YOB≥1982)			0.0247*	0.0144	0.0144	0.0145	0.0133
			(0.0146)	(0.0182)	(0.0182)	(0.0182)	(0.0122)
1(YOB≥1983)				0.0132	-0.00182	-0.00179	-0.00184
				(0.0139)	(0.0186)	(0.0186)	(0.0132)
1(YOB≥1984)					0.0190	0.0135	0.0150
					(0.0155)	(0.0197)	(0.0144)
1(YOB≥1985)						0.00712	-0.00454
						(0.0160)	(0.0120)
Female							-0.00165
							(0.00508)
Rural							0.000504
							(0.00629)

Household controls	No	No	No	No	No	No	Yes
Survey year FE	No	No	No	No	No	No	0.00359
							(0.00564)
Constant	10.16***	10.38***	10.66***	10.83***	11.00***	11.06***	11.46***
	(1.046)	(1.063)	(1.076)	(1.090)	(1.099)	(1.106)	(1.220)
Observations	8,079	8,079	8,079	8,079	8,079	8,079	7,958
R-squared	0.020	0.020	0.020	0.020	0.020	0.020	0.039

Note: A robust estimate of the VCE in each regression parentheses. This table reports the estimation of the completion of primary schooling of mother under the Law on Universal Primary Education (LUPE) on infant mortality rate, mathematically $LUPE_1$ = 1(year of birth of mother ≥ 1980), $LUPE_2$ = 1(year of birth of mother ≥ 1981), $LUPE_3$ = 1(year of birth of mother ≥ 1982), $LUPE_4$ = 1(year of birth of mother ≥ 1983), $LUPE_5$ = 1(year of birth of mother ≥ 1984) and $LUPE_6$ = 1(year of birth of mother ≥ 1985), respectively. There was restriction to mother who only ever born children. We control for the following all the columns: gender(female), father education, mother age, place of residence (rural), ethnicity, religion, wealth index quintiles, household ownership: dwelling unit, electricity, television mobile phone and motorcycle. Statistical significance is *** 1%, **5 % and *10%.

Table 4.0 describes the effect of mother education attainment affected by compulsory schooling law on infant mortality rate. The results show that birth cohorts of 1981, 1983 and 1985 born of mothers with completion on grade 4, grade 2, and grade 1, respectively have a negative relationship on their infant mortality holding household controls and survey year fixed effect in column (7).

3.5 Conclusions

This study estimates the impacts of maternal education on children under five years old of age with low height for age which is stunting, low weight for age which is underweight and low weight for height which is acute malnutrition, child mortality rate which is under five years of age and infant mortality rate which is under one year of age using simple ordinary least square estimation into two scenarios: (1) the simple comparison of mothers who were born in 1979 and 1980, and (2) employing year of birth of mothers who were born in 1980 and above till 1985 which is benefited from the compulsory primary schooling law in 1991.

Findings of our study show that the effect maternal primary school completion due to the Law on Universal Primary Education (LUPE) in Vietnam have no significantly impact on

children who are under five years of age with low height for age(stunting), low weight for age(underweight) and low weight for height (acute malnutrition), child mortality and infant mortality rates. In the case of simple comparison on the mother year of birth in 1979 and 1980, primary school completion of mother has only an insignificant relationship with stunting and underweight while it has an insignificant positive relationship with acute malnutrition, child mortality rate and infant mortality rate. In the case of second approach, overall, mothers who were born in 1982, 1983 and 1985 finishing grade 3, grade 2 and grade 1 respectively, which have a negative relationship with child health outcome. And mothers who were born in 1981 and 1983 completion on grade 4 and grade 2 respectively, which have a negative relationship with child mortality and infant mortality rates. Among them, the probability of competing primary schooling level (grade 2) of mother who were born in 1983 have significantly reduction on low height for age by 6.5 percentage points, which is benefited from the Law on Universal Primary Education (LUPE) in Vietnam in 1991.

In the following, we would recommend implementing similar law on universal primary education especially in developing countries. This would increase mother educational attainment since higher mother education have a casual impact on child health and child mortality.

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