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WOMEN'S EDUCATION AND FERTILITY AND CHILD MORTALITY EVIDENCE FROM VIETNAM 1989, 1999, AND 2009

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A Thesis Submitted in Partial Fulfillment of the Requirements
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บทคัดย่อ

การวิจัยครั้งนี้ มีวัตถุประสงค์เพื่อศึกษาความผันแปรในการศึกษาทั้งในช่วงเวลาและภูมิภาคของประเทศเวียดนามว่าสามารถอธิบายความผันแปรของภาวะเจริญพันธุ์และภาวะการตายของทารกในประเทศเวียดนามได้หรือไม่ แม้ว่ามีงานวิจัยเชิงปริมาณจำนวนหนึ่งได้ศึกษาความสัมพันธ์ระหว่างภาวะเจริญพันธุ์และการศึกษาแล้ว แต่ไม่มีการศึกษาเชิงปริมาณใดที่อธิบายปรากฏการณ์การเปลี่ยนแปลงอย่างมีนัยสำคัญต่อภาวะเจริญพันธุ์ การเสียชีวิตของทารก และการศึกษาในประเทศเวียดนาม ดังนั้น รายงานวิจัยนี้ใช้ข้อมูลระดับบุคคล เพศหญิงจากข้อมูลการสำรวจ Vietnamese Population and Housing Census ในปี 2532, 2542, และ 2552 ซึ่งจัดทำโดย IPUMS ภาวะเจริญพันธุ์และการตายของทารกใช้จำนวนเด็กที่เกิดขึ้นแล้วและจำนวนทารกที่เสียชีวิตตามลำดับ สำหรับตัวแปรการศึกษาพิจารณาจากระดับและจำนวนปีของการศึกษา ผลการศึกษาจากข้อมูลภาคตัดขวางในแต่ละปี พบว่า มีความสัมพันธ์อย่างผกผันระหว่างระดับการศึกษาและภาวะเจริญพันธุ์ในประเทศเวียดนาม การเข้าโรงเรียนของมารดามีบทบาทสำคัญต่อการรอดชีพของเด็ก อีกทั้ง การศึกษาของมารดามีอิทธิพลสูงสุดทั้งการลดลงของภาวะเจริญพันธุ์และการเสียชีวิตของทารกตลอดช่วงเวลาการศึกษา มีความเป็นไปได้ว่าความสัมพันธ์ที่เกิดขึ้นอย่างมากในการศึกษาของมารดา กับภาวะเจริญพันธุ์ และการรอดชีพของทารกเกิดขึ้นเมื่อเศรษฐกิจด้อยพัฒนา

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HAI YEN NGUYEN THI: WOMEN'S EDUCATION AND FERTILITY AND CHILD MORTALITY EVIDENCE FROM VIETNAM 1989, 1999, AND 2009. ADVISOR: LECTURER THANYAPORN CHANKRAJANG, Ph.D., 91 pp.

In this thesis, I aim at investigating whether the variation in education both over time and across regions in Vietnam can explain the variation in the Vietnamese fertility and child mortality. Although a number of quantitative studies on the association between fertility and education have been done, there is an absence of a quantitative insight based on the evidence from Vietnam, where fertility, child mortality and education has undergone significant changes. To do so, the thesis uses the female individual-level data from the sample of the Vietnamese Population and Housing Census from the years 1989, 1999, and 2009, provided by IPUMS. In this thesis, fertility measure is based on the number of children the individual has ever born, child mortality is estimated by the number of child death, and education is measured as both levels and years. Using separate cross sectional analysis for each year, the results show that there is indeed an inverse relationship between educational and fertility and in Vietnam. The results also show the vital role of mothers' schooling on child survival. Interestingly, the magnitudes of the influence of mother's education on both fertility and child death fall over time, possibly suggesting that mother's education has a stronger relationship with fertility and child survival under the situation when the economy is less developed.

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ABBREVIATION

ASFR : Age specific fertility rate

CEB: Children ever born

CMR: Child mortality rates

CFR : Completed Fertility Rate

IMR: Infant mortality rates

TFR: Total fertility rate

UN : United nation

WHO World health organization

1. Introduction

Vietnam is one of the Asian countries that have a rapid change in demographic transition and demographic dividend .It is standing at the end of first stage of demographic dividend .It is a country with a relatively large population size, and population growth rate is still quite high .As reported by the census of population and housing in 2009, the population of the country is 85.78 million)of which :in rural areas accounted for 70.4 %of the population, urban areas accounted for 29.6 (%and is currently ranked 3rd in Southeast Asia, and 14th in the world .Population increased by about 1.1 million people every year .According to the General Statistics Office, Vietnamese population will exceed 100 million by the year 2024, and the population density will be up to 335 people/km^2 .

Although the total fertility rate in Vietnam is currently at approximate replacement level)TFR =2.1 in 2014(, Vietnam is facing differential in fertility across regions .In many poor areas, low living standards, the fertility rate remains high)even very high as the Kon Tum have TFR of 3.45 children/woman(, while developed localities, with high living standards, the fertility rate below replacement level)even lower than the limit of 1.5 children /woman, as Ho Chi Minh City was only 1.45 children /woman (Department of Population and Labour Statistics, 2010; Goodkind, 1995) . Currently there are 35 provinces with fertility rate lower than the replacement level

)TFR <2.1 (and 28 provinces with higher fertility rate than the replacement level)TFR> 2.1 ((General Statistic Office, 2011).

Facing with high and densely population, the Ministry of Health of Vietnam through the Strategy about Population and Reproductive Health Vietnam in 2011-2020 seeks to maintain reasonably low fertility)TFR of 1.9 children /woman(and to stabilize the population size in the 115-120 million people in 2050, making the task related to fertility identified as urgent .As such, to understand factors related to or factors determining fertility differences not only can contribute to academic literature but can also have some policy implication.

In addition, nowadays mortality become a huge concern not only in Vietnam but also in the world, particularly the infant and child mortality .Although infant and child mortality are all decreasing over the past decades (Cu, 2007; WHO, 2010), It is evident from general statistic office show that child mortality rate are different by region. This rate is lowest in Southeast and highest in Central Highlands around 15.0 and 41.6 child deaths. (Note that unit is per 1000 live births) (General Statistic Office, 2010). According to the World Health Organization, Vietnam has some striking differences in child mortality by region, ethnicity and living standards. Compare with

the plains areas, child deaths rate in highland or tableland are two or three times (Nguyen-Dinh, 1997; WHO, 2015).

Furthermore, it is widely recognized that education plays a crucial role in individual's well-being and social development .The majority of countries around the world have attempted to invest in education in order to enhance the quality of life for inhabitant .In program of action of the 1994 International Conference on Population and Development in Cairo, Egypt, the role of education has been emphasized as the key to the revolution in fertility (UNFPA, 1995) .Besides, women's education is more likely to have an impact than men's education (Bratt, 2003; Breierova & Duflo, 2003; Stroobant, 2006) . Female education has a greater impact on age of marriage and delayed fertility than male education (Pradhan, 2015) .It is evident from previous research that women's education could be seen as vital role in fertility and child mortality (Binh, 2013; Kravdal, 2002; Lesthaeghe, Vanderhoeft, Becker, & Kibet, 1985; Liljestrand, Peña, Zelaya, & Persson, 1999; Martin, 1995; Nations, 1995; Pradhan, 2015; Ware, 1984) .

Many factors, including education, have been found to be related to fertility and mortality (Blossfeld & Huinink, 1991; World Health Organization, 2016) .That is partly because education is an indicator of human capital .Moreover, schooling is also

an important factor in the decision of fertility and mortality, especially education for women (Breierova & Duflo, 2003; Cochrane, 1979) .During the past period of fertility and mortality decline in Vietnam, significant changes in women's education are also observed (Binh., 2005; Haughton, 1997; Nguyen-Dinh, 1997) .

Existing studies also reveals that similar to the fertility and mortality pattern, there still exists the differentials in literacy rates and women's education across the regions in Vietnam (Cu, 2007; Haughton, 1997; Nguyen-Dinh, 1997) .Research on Vietnam's current fertility and mortality rate has important significance in ensuring sustainable socio-economic development Vietnam today .

This thesis, as a result, aims to investigate whether the variation in education both over time and across regions in Vietnam can explain the variation in fertility and mortality both over time and across regions .Besides describing the trend and pattern of fertility and child mortality in Vietnam among 1989, 1999 and 2009 in Vietnam, the thesis illustrates the relationship of women's education with fertility and child mortality.

Despise numerous studies on the association women's education with fertility and child mortality around the world (Becker, 1960a; Breierova & Duflo, 2003; Rodolfo A. Bulatao, 2001), in Vietnamese context, this association has not been considered

carefully .In general, work on this topic has not been established and it usually belongs to a small part of research .Futhermore, previous studies are conducted with small sample size in which information is collected from only a small part of the residents, and from that conclusions are reached regarding the general population instead of using data of whole country like Census.

In addition, a number of quantitative studies on the association between fertility and mortality and education have been done, there is an absence of a quantitative insight based on the evidence from Vietnam, where fertility, mortality and education have undergone significant change .This thesis, thus, in particular uses the data from the Vietnamese Population and Housing Census from the years 1989, 1999, 2009 to study such the research question.

The rest of the thesis is as follows .Section 2 gives some background of fertility, mortality and women's education in Vietnam, section 3 contains a review of the related literature .Section 4 outlines the research objectives .Section 5 describes the data used in the subsequent study and measure main variables .Section 6 explains research methodology .Section 7 presents some findings and discussion about fertility, mortality and women's education over time and across regions in Vietnam and

compares the results with some previous studies .From these findings, section 8 covers the conclusion, discussions, limitations and some recommendations .

2 .Background

In this section, I introduce some general information about social context and the overall situation of fertility and mortality and education of Vietnam

2.1 .Population policy and family planning

The process of population growth, and population policy and family planning related to fertility in Vietnam outlined in this sub-section is heavily based on Bryant)1998 (and Committee for Population)2003 .(In 1957 the UN General Assembly passed a resolution on the issue of population .The aims of resolution encourage the Government to follow "family planning" to reduce rapid population growth, particularly in the developing countries which accounted for 67 %of the world population in 1950 . Likewise in Vietnam, when the population reached over 30 million, and before the period of rapid population growth, Prime Minister Pham Van Dong issued the Decision No .216-CP of birth control instruction in December 1961 .This decision was very important in the field of population and family planning of Vietnam .Based on the characteristics of the history of Vietnam, we can divide the process of formation and development of population policy and family planning into the following stages:

The period from 1961 -1975 :During this period, Viet Nam was divided into South and North .Within five years from 1955 -1960 Vietnam population increased by 5 million, larger than the population increase during the past 15 years)from 1939 to 1954 the population increased by only 4.235 million .(This period, the war was happening in the South, so population policy -family planning is done only in the North .The main objective of this phase is towards family size with three children .The basic solution is to provide foundation services, family planning and advocacy . Government paid all the full cost of services and family planning .The birth rate in the north fell down from 43.9 %in 1960 to 32.2 %in 1975 .The total fertility rate fell from 6.39 in 1960 to 5.25 in 1975 (Hoa et al., 1996).

The period from 1975 -1991 :After 1975, the country was reunified .The population was about 48 million people, doubling from 1954)23.835 million .(During this period, the family planning was applied throughout the country .In 1989, the National Committee for Population -Family Planning was established .Population and family planning policy of this stage was to campaign for birth plan .The goal of this campaign was for a family to have two or three child, delay the age of first birth)22 years old and older(, and increase birth spacing)from three to five years .(It is claimed

that as a result of such policy, total fertility rate was reduced to 3.8 children and the birth rate to 30.1 %in 1989 (Goodkind, 1995).

Period 1991 -2000 :In 1993, the population and family planning policy was incorporated into the Resolution of the Communist Party of Vietnam and the strategy of population and family planning for 2000 .This strategy was approved by the Prime Minister's Decision No .270 / TTG, 3 June 1993 .The population and family planning strategy has set a target to 2000's "to reduce, the rapid rate of having a third child and higher order birth so that the total fertility rate can reach 2.9 or lower and the population size of smaller than 82 million people in 2000 ".To accomplish this goal, the campaign "stop at two children "was widely promoted .It is observed that in 1999, the total fertility rate fell to 2.3.

From 2001 to present :The overall objective of the population policy and Family planning is a small family)one to two child(, healthy, to stabilize the population size, improve population quality, improve quality of human resources .This goal is accomplished by the media -education for change behavior in reproductive health care and family planning .In addition, in 2003, the Population Ordinance was issued by National Assembly Standing Committee .However, Article 10 of the Population Ordinance in 2003, has made misled the people that the Ordinance gives people the

rights to decide the number of children, so a third birth rate has increased upwards than before .Thus, in 2008, the National Assembly Standing Committee has revised Article 10 of the Population Ordinance 2003)Ordinance No .15/2008 /PL-UBTVQH12 dated 27/12/2008 (and specifying the model families with one or two children

2.2 General fertility in Vietnam

In this section, I provide a broad picture of the total fertility rates in Vietnam . The total fertility rates are relatively stable in recent years, but disparities between regions are quite large in Vietnam .(GOS, 2010)

Table 1: Total fertility rate by area, from 1999 to 2009

Changing TFR of Vietnam through the period

Year	Total	Rural	Urban
1/4/1998 – 31/3/1999	2.33	2.57	1.67
1/4/2000 – 31/3/2001	2.25	2.38	1.86
1/4/2001 – 31/3/2002	2.28	2.39	1.93
1/4/2002 – 31/3/2003	2.12	2.3	1.7
1/4/2003 – 31/3/2004	2.23	2.38	1.87
1/4/2004 – 31/3/2005	2.11	2.28	1.73
1/4/2005 – 31/3/2006	2.09	2.25	1.72
1/4/2006 – 31/3/2007	2.07	2.22	1.7
1/4/2007 – 31/3/2008	2.08	2.22	1.83
1/4/2008 – 31/3/2009	2.03	2.14	1.81

***Source**: General Statistics Office Vietnam (2010), Census of Population and Housing in Vietnam in 2009. The main results, Hanoi, Viet Nam.*

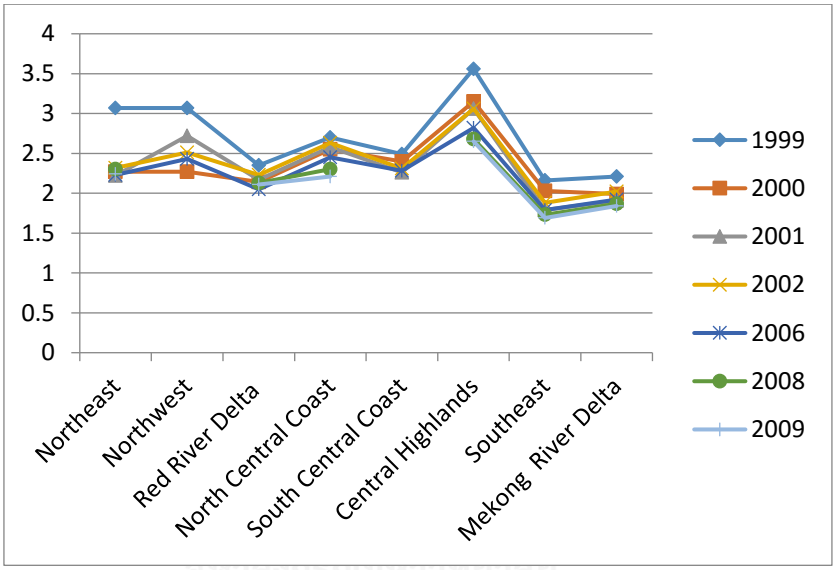
Over the 20 years, the TFR in Vietnam has changed significantly. TFR in Vietnam in the period 1999 - 2009 has fallen sharply from 2.33 to 2.03 between 1999 and 2009. In 2004 the TFR is higher than that in 2003 possibly due to 2003 is a good year for giving birth (goat year in lunar calendar). Then 2005 TFR declined sharply and keeping decline trend until 2009. The plummeted TFR importantly contributes to the reduction in the level of population growth in 10 years.

Regarding TFR of whole country from 1999 to 2009, it is interesting to see that total fertility rate has fluctuation from 1999 to 2006. But in 2006, the parttern of fertility in Vietnam decrease stably and achieves below replacement fertility level. Nevertheless, child per women in 2009 in countryside always have higher than metropolitan

The difference in the TFR is evident when comparing rural with urban areas. TFR in urban areas in 2009 is lower than in rural areas (1.81 children / women compared with 2.14 children / woman). Because psychological of having many children are still quite common in some rural areas. In addition, access to health services, reproductive health care and planning families in rural areas, especially remote areas is still limited

when compared to urban areas. So some women still have difficulty in limiting pregnancies and unwanted births. In addition, the rate of infant mortality and child mortality in urban are lower than in rural areas, as well as effective in reducing the replacement demand in this area. (Binh, 2013)

Figure 1: Total fertility rate by region from 1999 to 2009 (Unit: Children per woman)



Source: Own calculations based on data from the Census in Vietnam

In 2008, Northeast and Northwest become Northern Midlands and Mountains. During the past 10 years, the Highland region experiences the highest fertility rate in the whole country. In 2009, this region's TFR was 2.65 children/woman, which was higher than the national average (2.03 children/woman). The second highest fertility regions were the Northeast and Northwest (collectively the Midlands and northern mountains) with TFR in 2009 was 2.24 children/woman. The region with the lowest

fertility rate is the Southeast (1.69 children/women). In contrast, the Southeast and the Mekong River Delta had low TFRs at 1.69 and 1.84, respectively.

From the above figure, it can clearly be seen that there exists differential in fertility among different regions in Vietnam. In this thesis, I examine whether women's education relates to the difference in fertility pattern and trends in Vietnam

2.3. General Child mortality in Vietnam

During the recent years, Vietnam has had much considerable success in health care in order to increase the life of the people. Mortality is an important research topic in demography. In demographic studies mortality along with fertility is a significant factor to determine the rate of population growth as well as quality of population.

Table 2: Child mortality rate by Socio-economic region, 2009.

Unit: per 1000 live births

Socio-economic region	Child mortality rate
Red River Delta	37.2
Northern Midlands and Mountains	18.6
North and South Central Coast	25.8
Central Highlands	41.6
Southeast	15.0
Mekong River Delta	20.0
Entire country	**24.1**

Source: *General Statistics Office Vietnam (2010), Census of Population and Housing in Vietnam in 2009. The main results, Hanoi, Viet Nam.*

There is quite a clear difference in child mortality rate by socio-economic region in Vietnam. Southeast is the region with the lowest (15.0 child deaths per 1000 live births) and the highest is in the Central Highlands (41.6 child deaths per 1000 live births).

Table 3: Average number of children in Vietnam in 3 years 1989, 1999, 2009

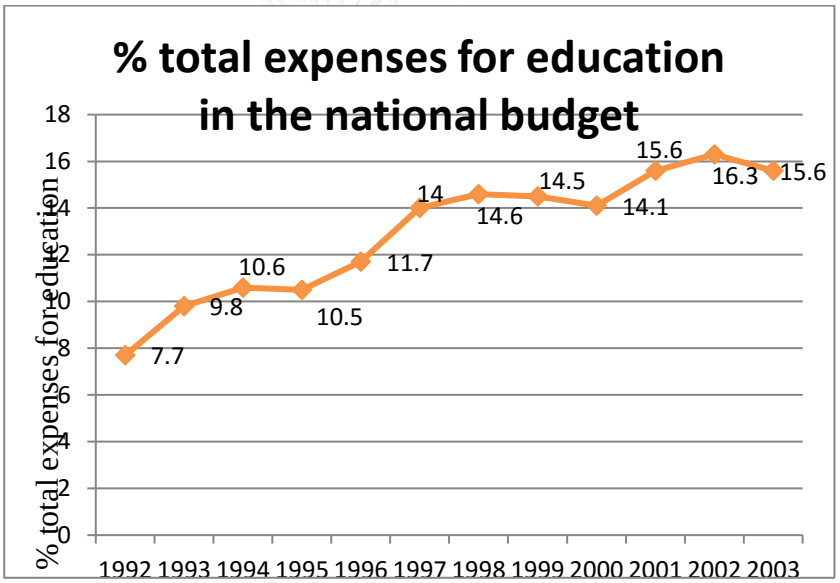
	Mean		
	1989	1999	2009
Children ever born	3.09	2.59	2.16
Children dead	0.18	0.09	0.04

The results recorded that the birth rate decreased continuously in Vietnam, the average number of children ever born dropped from 3.09 children in 1989 down 2.16 children in 2009. This possibly shows that Vietnam has implemented aggressive and successful in programs and policies on family planning, completed aiming that each family only have 1 or 2 children, and reduced TFR to replacement level. Based on the achievements of fertility decline, population growth has slowed and the population size in 2009 was 85.8 million people, which was much lower than the target of Population Strategy of 89 million people by 2010. Note that, if fertility rates remain as 1989, according to the forecast, Vietnam population was to be up to 104.4 million in 2009, which means already limited by 18.6 million people. Child mortality rates also continued to decline from the average number of children death at 0.18 children in 1989 down to 0.04 children in 2009 (Nguyen & Pham, 2010) (Table 3).

2.4. Education in Vietnam

Education is always a top concern of Vietnam in formulating government policy. The education reforms that started in 1954 has now undergone three major stages and achieved many significant achievements. Current national budget for education grew steadily from 7.7% in 1992 to 15.7% in 2003 (Ministry of education and training, 2014)

Figure 2:% total expenses for education in the national budget from 1992 to 2003



Source :construct based on data from Ministry of education and training 2014

Education for women was the focus of recent years and has achieved considerable success .However, the proportion of education was also uneven across regions in the country (Huong, 2012) (Binh., 2005; Phuoc, 1974).

Table 4: Literacy rate in Vietnam by place of residence from 1989, 1999 and 2009

	1989	1999	2009
Female	82.7	86.9	91.4
Urban	93.8	94.8	97.0
Rural	85.4	88.7	92.0

Source :Vietnam Population and Housing cencus 2009, Education in Vietnam : Analysis of key indicators

According to Table 4, the literacy rate of the population is calculated for the population aged 15 years and over)literacy of adults .(The data show that there are differences between urban and rural literacy rates .However, this difference has decreased significantly in the last 20 years .In other words, there has been a significant improvement in women's education in the past 20 years .In addition, the proportion of literate urban is higher than rural areas)97 %and 92%, respectively.(

Table 5: Literacy rates of the population aged 15 and older by region, sex and urban-rural residence, 2009

Region	Total	Male	Female	Urban	Rural

Northern midlands and mountains	87.3	92.0	82.8	97.0	85.3
Red River delta	97.1	98.7	95.6	98.7	96.5
North and south Central Coast	93.9	96.3	91.7	96.4	93.1
Central Highlands	88.7	92.3	85.1	96.2	85.5
Southeast	96.4	97.4	95.4	97.6	94.7
Mekong River delta	91.6	93.9	89.5	94.0	90.9

Source :Vietnam Population and Housing cencus 2009, Education in Vietnam : Analysis of key indicators

From Table 5, the data show that there are differences between socio-economic regions and the literacy rates .The Red River Delta and the southeast are more developed than the rest of the country, especially when compared with northern mountainous and Central Highlands .The differential in literacy between men and women varies from region to region .In the northern mountainous and Central Highlands, in particular, the percentage of women aged 15 and older no literacy in rural areas in 2009 was equivalent to)or even higher (than the proportion of rural men 20 years ago .

The literacy rates vary from region to region .The Red River Delta had the highest literacy rate at 97.1 %, and the Northern midlands and mountains had the

lowest rate .Thus, increased efforts to increase literacy in the Northern midlands and mountains not only will narrow the regional gaps, but also will increase the overall literacy rate of the country .

It can also be deduced from the table that sex differential in literacy rates is generally greater in rural than urban settings .In addition, even among females, literacy rates in rural areas were substantially lower than that in urban areas, especially in the Northern midlands and mountains and Central Highlands regions where women were the most disadvantaged in terms of literacy (GOS, 2010)

3 .Literature review

This section will provide brief definitions of fertility and mortality and also review the literature from existing studies on the relationship of women's education with fertility and child mortality .

3.1 Definitions and *theories related to fertility*

Fertility in standard English demographic usage, refers to the actual reproductive performance, as measured in live births, of a woman, or population (Ross, 1982) .According to Weeks) 2014(, fertility is the actual level of reproduction of a population that depends on the number of live births .While James suggests that fertility is about how many children women have in during childbearing age .In a ‘high

fertility' society women have many children and a 'low fertility' society women have fewer children .Measuring fertility has connection with the number of live birth to a specific population and time reference period (Palmore & Gardner, 1994; Sutton, 2002; Weeks, 2014) .On the other hand, another importance term reflects the biological aspects of fertility are fecundity .This term biological ability of women can birth to a certain number of children) Fecundity is a measure of the physical ability to have children .(A fecundity difference with fertility is that fecundity of childbearing potential biological while fertility is about how many children women have .Some women are possible fecundity but they cannot have children because of many different reasons . Natural fertility refers to the absence of parity-specific family planning, meaning that couples are not regulating their fertility based on their current parity (Caldwell, 2001; Weeks, 2014; Wongboonsin, 2014) .The "maximum' fertility in absence of any fertility control is 16 children per woman with assume female fecundity from age 15-49, 9 months of pregnancy and 18 months of breast feeding (Demeny & McNicoll, 2003; Wongboonsin, 2014; Wood, 1994) .In this thesis, I aim to consider fertility which is understood that how many children women have .

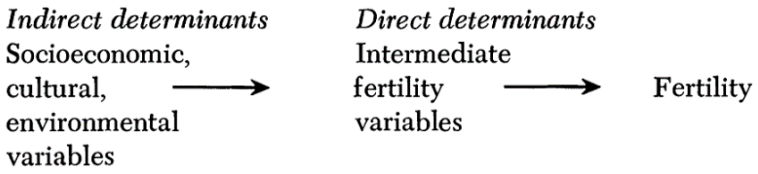
In addition, fertility is a concept which is used in many disciplines. This term becomes familiar not only demography but also in public health. Regarding researching

in fertility, scholars tend to investigate in the determinants of fertility, which has been a current research subject. Therefore, there are a number of theories applied from other disciplines as economics, sociology, history, and psychology. Some prominent examples is the application of theory of Malthusian, theory of demographic transition, theoretical framework of David and Blake, Bongaarts' model of components of fertility and supply – demand framework (Becker, 1960b; Bruijn, 1999; Joshi & David, 1996; Malthus, 1976).

Moreover, fertility depends not only on the biological factors, but it also depends on abiotic factors, including economic factors, social, political and cultural (Bongaarts, 1976, 1982). We can see this more clearly in the theoretical framework analysis of the factors directly affecting fertility by David and Blake. According to these authors, there is only 11 factors directly affecting fertility. These elements are grouped into three groups of factors: Factors affecting exposure to intercourse: “intercourse variables”: those governing the formation and dissolution of unions in the reproductive period, those governing the exposure to intercourse within unions (Voluntary abstinence), factors affecting exposure to conception “conception exposure” (se or non-use of contraception or by other means), factors affecting gestation and

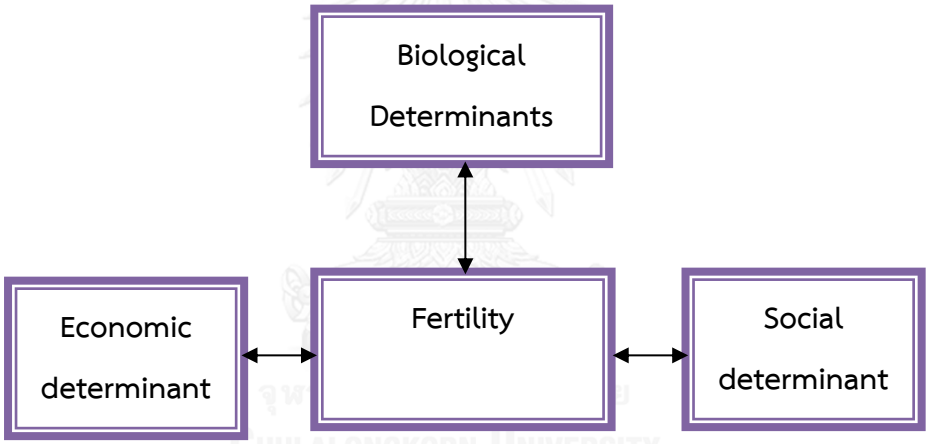
successful parturition “gestation variables”, mortality from involuntary causes and fetal mortality from voluntary causes (Bongaarts, 1982; David & Blake, 1956).

According to Bongaarts, we can see a simple diagram summarizes the relationships among the determinants of fertility (Bongaarts, 1976) as follow



Source: Bongaarts, J. (1976). A Framework for analyzing the proximate determinants of fertility Population studies, 30(2), 227-241

Furthermore, Jean-Paul Rodrigue developed the farmework to explain how the factors influencing fertility



Dr. Jean-Paul Rodrigue “Population, Resources and Environment.”

a) Biological determinants: include age (reproductive age of woman),Health and nutrition, Environment

b) Social determinants: Marriage, Contraception, Abortion

c) Economic determinants: The role of children or their “value” affects fertility.

3.2. Relationship between women's education and fertility

There are a number of theories about the determinants of fertility (Benporath, 1980; Bongaarts, 1976; Bruijn, 1999; Caldwell, 1980; Weil, 2013) .However, in this thesis, my concern is about the relationship between women's education and fertility .The reason why women's education is an important factor that has an impact on fertility could be because it could be managed by government policy (Smith, 1996) .Some research throughout the world reveals that fertility, mortality and education always have tight relationship (Kravdal, 2002; Pradhan, 2015; Weinberger, 1987) .From the literature review, both the inverse relationship between education and fertility)increased education lead to decreased fertility (and a positive relationship between women's education and fertility)increased education leads to increased fertility (have been found (Cochrane, 1979) .Nevertheless, in this section, I focus on the conceptual frameworks that relate education and fertility inversely .Earlier empirical studies argue that there is a strong inverse relationship between education and completed fertility in developing countries (Arokiasamy, McNay, & Cassen, 2004a; Kravdal & Rindfuss, 2008) .

Both recent theory and empirical evidence therefore suggest that there is inverse association between women's education and fertility .Most of the literature

provides strong evidence that women's schooling continues to play an important role in decrease fertility in many countries around the world .For instance, educated women have lower fertility than uneducated women in India (Arokiasamy et al., 2004a),

The association between women's education and fertility is a rather complex and multifaceted .The impact can occur through several channels or sooner or later on women from delay married to providing knowledge which take care their children . Women's schooling may influence fertility both indirectly by affecting marriage duration, age at marriage, delay marriage, and directly through its effect on marital fertility (Bratt, 2003; Smith, 1996) .The economic theory of fertility suggests that more educated women have higher opportunity costs of bearing children in terms of lost income (Becker, 1960b) .The influence of maternal education on fertility can occur by many ways as following:

First of all, women's education potentially delays the age of marriage, resulting in a shorter period for reproduction and hence smaller number of children (Becker, 1960a) .According to Cochrane) 1979(, going to school for a longer period leads to an increase in the age of marriage, and in some countries to the reduction of the probability of ever married (Cochrane, 1979) .Earlier studies document extensively that increased women's education has a positive relationship with age of marriage .This

result is verified by world fertility surveys in 38 developing countries such as Morocco, Egypt, Bangladesh, Yemen and Mexico (Weinberger, 1987) .Moreover, Brien and Lillard)1994 (find that female education and age at marriage are associated both at individual and societal levels .Women having a secondary-school education are considerably less likely to have early marriage than lower educated women in Malaysia (Brien, Michael, & Lillard, 1994) .Later ages at marriage is often related to later schooling leaving and for this reason with more education, women tend to delay marriage longer than others in Venezuela and Germany (Cheal, 2008) .With regard to gender, scholars find that female education is a stronger determinant of age at marriage and early fertility than male education in Indonesia (Breierova & Duflo, 2003).

Some hypotheses suggest that women delay marriage because they put off the transition from youth to adulthood while they are attending schooling .That is partly because education take time and affect to roles of mother or housewives (Blossfeld & Huinink, 1991).

Secondly, education gives women the ability to have higher incomes, so that women can have fewer children with higher quality (Becker, 1960b) .Schooling associated with high income increases the opportunity cost of bearing children .Thus women may decide to have fewer children due to a higher potential forgone income .

Higher educated women with higher income may depend less on children. This limits the resource flow from children to women .Having children is no longer providing higher educated women with sources of income)from child labor (but represents burden .Thus, fertility among higher educated women is potentially lower (Caldwell, 1976, 1994; Robinson, 1971) .

Thirdly, education improves knowledge and attitude that relates to reproduction and fertility, such as contraception, healthy pregnancy behaviors, value of children (Becker, 1960a; Bongaart & San, 1994; Brien et al., 1994; Cochrane, 1979) . In particular, education may improve an individual's knowledge of, and ability to process information regarding, fertility options and healthy pregnancy behaviors (Becker, 1960a) .Cochrane)1979 (suggests that education has a positive relationship with attitude of preferring birth control measures, with better understanding of contraception, and strengthened couple relationships .Female schooling may affect fertility through knowledge and more effective use of contraceptive methods (Rutenberg & et al, 1991; Schultz, 1997) .By enhancing women's position within family and social, schooling increase women's control over reproductive choices .Thus, through having better knowledge on fertility control, education can potentially have an effect on fertility reduction (Bruijn, 1999) .Martin) 1995(, in resulting from 26

demographic and health surveys, shows that highly educated women have conceptive prevalence rates 27 and 38 percentage points higher than uneducated women in North African countries .The similar trend was found in Burundi, Mali, Liberia and Uganda .In addition, Martin) 1995 (finds that better educated women revealed the highest rates of contraceptive use in Zimbabwe and Indonesia .Nevertheless in Mali, Sri Lanka, Bolivia and Peru some also discover that the impact of education on women's contraception choices could be dominated by cultural factors (Martin, 1995) . Moreover, some also discover that the impact of female's education on contraceptive use is significant stronger than male in most countries in North African, Latin American (Blake & Pinal, 1985; Breierova & Duflo, 2003; Osili & Lon, 2008)

In addition, education may lower fertility through the improvement in child health and reduced rates of child mortality, as women need to have fewer births to yield the same desired family size (Schultz, 1997) .More educated women know more about prenatal care and child health, and hence might have lower fertility because of greater confidence that their children will survive .Women's education may increase female autonomy and bargaining power in fertility decision)Mason, 1986(, leading to a fall in fertility .Breierova and Duflo)2003 (find that female and male education seem equally important factors in reducing child mortality .But Male's education is a stronger

determinant of age at marriage and early fertility than women's education .However, women's education is determinant number of child in their family (Breierova & Duflo, 2003) .

As a result, a number of studies proposes that women's education makes a dramatic change in the TFR (total fertility rate) (Cochrane, 1979; Martin, 1995; Smith, 1996). The TFR of educated women is less than a half of that of less educated women in Jordan and Sudan. Moreover, TFR for women who have had seven or more years of education is approximately 40 percent lower than other women in some Latin American countries (Weinberger, 1987). Another study found that increasing female education by one year in Nigeria reduced early fertility by 0.26 births. (Angrist & Krueger, 1991). In sub-Saharan Africa such as Ethiopia and Ghana the higher the level of a woman's education attainment, the fewer children she is likely to bear. To be more specific, there is evidence from data in Ghana showing that women with a high school education have a TFR between 2 and 3, whereas those with no education have a TFR of about 6, even as recently as in 2008. Similarly, women with a high school education in Ethiopia have a TFR of 1.3 (Pradhan, 2015). Smith (1996) has also revealed that woman who had eight years of schooling is more likely to have 1.07 children than woman who had 12 years of education in Iowa.

Moreover, the evidence from sub-Saharan Africa shows that an education reform in Kenya that increased the length of primary education by a year leaded to increased girl educational attainment, and delayed marriage and fertility. Additionally, reducing the cost of school uniforms in Kenya not only reduced dropout rates, but also reduced teenage marriage and childbearing (Angrist & Krueger, 1991) (Kravdal, 2002). Another research uses data from the 1993 Survey of Household income and wealth conducted by the Bank of Italy show that increasing education up to the upper secondary level exerts ceteris paribus a positive effect on marital fertility at ages 21-39 and that highly educated women postpone fertility (Bratt, 2003).

Besides, urban women had lower fertility than rural women with the same level education .Rural women educated in or beyond grammar school had lower fertility than rural women with only common schooling (Osili & Lon, 2008; Smith, 1996) . However, there are some evidenc that with the similar level of schooling Catholic women and Protestant women did not have fertility different .It shows that education did not affect Catholic women differently from Protestant (Kravdal, 2002; Smith, 1996).

The role of education in fertility appears stable over time .There was no difference between the educational variables and age group .Earlier study observes

that the impact of education on fertility of women who born during the period 1850 to 1885 have the same trend in Iowa state in the nation of United States (Smith, 1996).

The evidence from literature review clearly supports that the causal role of female education in fertility decline .Notwithstanding, other studies have also proved that there are positive association between women's education and fertility .According to Martin)1995(from the Demographic and Health surveys for 26 countries, it is notable that in some of the least developed countries women's schooling can lead to a positive impact on fertility at the lower end of the education range .The inverse relationship could not be seen in some of poorest societies .(Cochrane, 1979) .In many poor or rural societies in Kenya, the effects of female's education were negligible on fertility (Lesthaeghe et al., 1985) .Furthermore, it is important to note that women's education is not the only factor influencing to fertility. Some factors such as nutrition, family planning and etc .can contribute to changing fertility (Joshi & David, 1996; Ministry of Health, 2011).

From the majority of these studies described above demonstrate that there is the inverse association between women's education and fertility in the world .My thesis attempts to point out the distinctive role of education in influencing the fertility behavior of women in Vietnam.

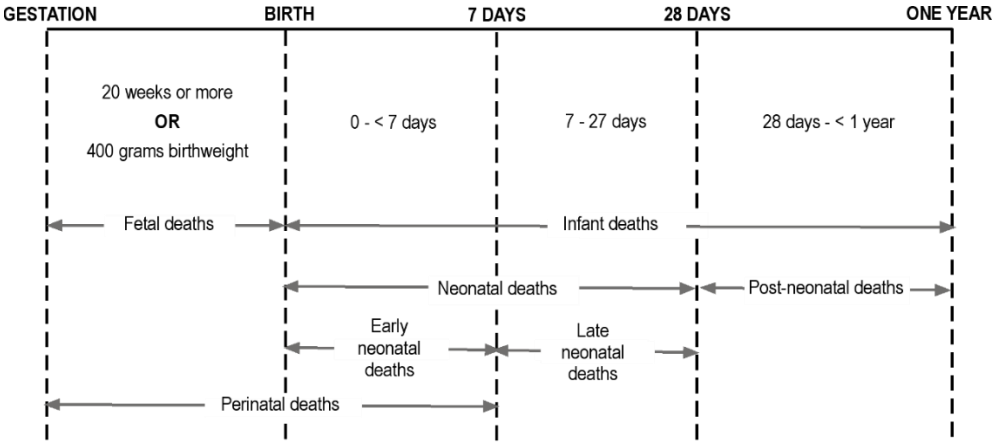
3.3. Relationship between women's education and mortality

In addition to fertility, mortality could be seen as key concept in demography . It considers many kinds of death such as fetal deaths, early neonatal deaths, late neonatal deaths, post-neonatal deaths, and child mortality. Nevertheless, in my thesis, I consider mortality which is divided into child mortality and infant mortality, which is also intensively studied in demography (Liljestrand et al., 1999) .

Infant mortality, which is defined as the probability for a live-born child to die before its birthday, is a multifaceted phenomenon that needs to be placed in is historical, geographic and social contexts (Barfield, 2011; Stroobant, 2006) .Measuring mortality has connection with the number of live birth to a specific population and time reference period (Palmore & Gardner, 1994) .Meanwhile, a live birth which is defined by United Nations) 1955 (and World Health Organization) 1950 (are as follows . It refers to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life -e.g .beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles -whether or not the umbilical cord has been cut or the placenta is attached .Each product of such a birth is considered live born (United Nations Statistical office, 1995; World Health

Organization, 1950) .In demography infant mortality rates caculated as the number of deaths to children under age 1 per 1000 live births in the reference period, usually one year and this rates is usually measured by the ratio between the number of dead children per thousand before reaching 12 months of age in the year divided by the total number of children born in that year .Actually, it is difficult to estimate the number of person years lived for children under age because the requisite statistics are not collected or not published (Palmore & Gardner, 1994; Weil, 2013)

A glance at the diagram below provided reveals that specifies periods for the terms used for fetal and infant deaths (Ministry of Health in New Zealand Crown, 2010).



Source: Ministry of Health in New Zealand. 2010. *Fetal and Infant Deaths 2007 Report*

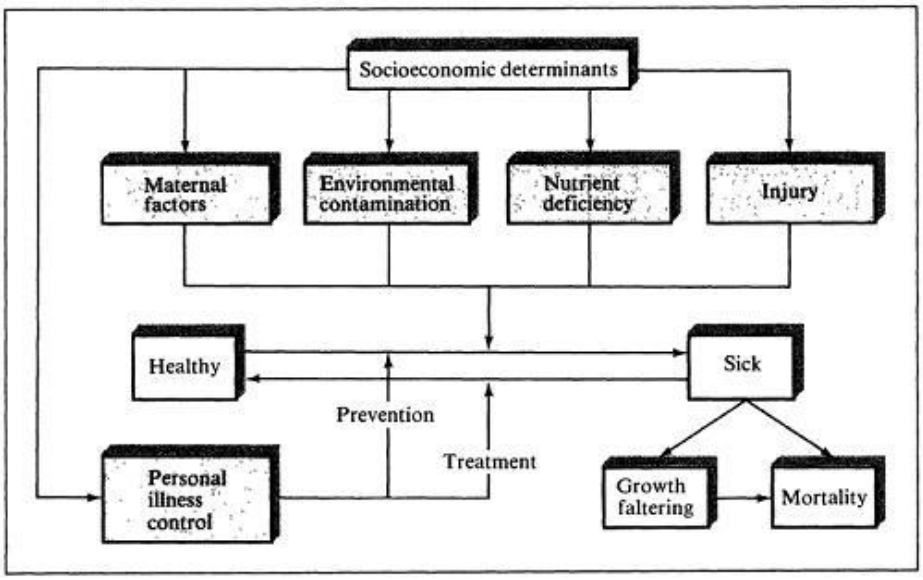
Moreover, child mortality is defined as the probability of dying between the 1st and 5th birthdays (Mwale, 2005). Child mortality is defined as the number of dead children age under 5 per 1,000 live births in the years .(Barfield, 2011)

Health organizations around the world have determined that there are six main causes of child deaths :acute lower respiratory infections, mostly pneumonia)19(%, diarrhoea)18(%, malaria)8(%, measles,)4(%, HIV/AIDS)3(%, and neonatal conditions, mainly pre-term birth, birth asphyxia, and infections)37 .(%Malnutrition is a factor in more than half of the children who die after the first month of life .Children in developing countries are ten times more likely to die before the age of five than children in developed countries (WHO, 2010).

It is widely accepted that the issues child mortality is a matter of serious concern for the human as well as social development .According to WHO, 5.9 million children under age five died in 2015, 16000 every day (World Health Organization, 2016) .The high mortality levels usually happen in many poor countries around the world (Pampel, 2001) .We can see the effort of countries in decreasing fertility over many ways, however in some areas child mortality maintains at a high rate (Swenson, Thang, San, Nham, & Man, 1993) .For instance, although there has been a slight decline in Infant Mortality Rate and Under-Five Mortality Rate in India .The rate of decline in current decade is higher than in the previous, and it is still high in some states namely Kerala, Tamil Nadu, Maharastra, Punjab, Himachal Pradesh and West Bengal (UNICEF, 2014).

There are many roots of child mortality in the developing world, and their impact varies in variety of countries in the world .Beside finding causes of child mortality, some scholars give determinants influence the survival of children .Mosley and Chen) 1984(supplied a framework of proximate determinants of child survival in developing countries .The proximate determinants are grouped into five categories : maternal factors; environmental contamination; nutrient deficiency; injuries; and personal illness control)prevention, treatment ((Mosley & Chen, 1984).

An analytical frame-work for the study of child survival in developing countries



Source: WH Mosley & LC Chen (1984). An analytical frame-work for the study of child survival in developing countries. *Population and Development Review* 1984

Thereout, it is notable that child)or infant(mortality can be a result of two main factors including social characteristic and medical factors such as a weak health services and health systems, lack of nutrition as well as water supplies and sanitation facilities and ect .One of the most social significant factor can impact to child mortality is women's education (Caldwell, 1979b; Mei, Grummer-Strawn, & Stupp, 1998; Swenson et al., 1993).

There are various studies about women's education and mortality. Similarly to fertility, a similar trend was found in mortality that women's education and mortality have inverse relationship (Caldwell, 1979b). The negative relationship between the extent of maternal education and the level of child mortality could be seen in India, Bangladesh, Nigerian and etc. (Arokiasamy, McNay, & Cassen, 2004b; Ware, 1984). This inverse relationship is explained by the following reason. Women's possition and mothers' schooling notably influence child survival. The main key for women who have higher education is that they have knowledge about how to take care children when they get sick, so they can limit ability to happening child mortality. One of the pathways by which mothers' education affects child survival is through improved child care. Earlier studies in rural Punjab, India observe that child deaths are partly because of the poor education of some mothers. (Arokiasamy et al., 2004b; Guptaa, 1990). There is evidence from previous research supplied that the proportion of educated young women increased from 20% to 46% and this had also an impact on the overall child mortality decline that decreasing from 118 to 69 per 1000 during the observation period in Nicaragua 1964-1993(Liljestrand et al., 1999).

Furthermore, education gives women the autonomy and the confidence to take decision-making into their own hands .Actual knowledge of women help them

enhance their role in family and social thence they have power to determine the place child care and what kind of method is used to treatment for their children (Lee, Dung, Choi, Trinh, & Gia, 2016; Rutenberg & et al, 1991). In addition, women with higher education get higher income and better job (Blossfeld & Huinink, 1991) .So, with higher budget, they can have a better choice of food for their children .This has a special meaning in some areas such Bangladesh, where nutrition is an important determinant of health in order to reduce child mortality (Arokiasamy et al., 2004b).

In spite of existing studies that point out that mother's education is important to the reduction of child mortality, a decline in infant mortality can be the result of health interventions, specially targeted to poorer groups of women and their infants (Liljestrand et al., 1999).

The vital role of female and male education are combined in research child mortality, the results illustrate that both genders seems to be equally important factors in reducing child mortality in Indian (Breierova & Duflo, 2003) .Moreover, literacy is more likely to influence on child mortality than on infant mortal Latin America (Palloni & Rafalimanana, 1999; Ware, 1984).

One further view from demography approach) Haaga, 2001 (shows that there is a definite correlation between mortality and fertility .The relationship between

mortality and fertility has been mentioned in the long term .From pioneering theory of Frank Notestein to Davis have also showed that improved survival of children was a contributory cause of fertility reduction .It means that if a couple have a child who is died, they tend to have more babies than others (Coale, 1983; Cochran & O'Kane, 1977; Demeny & McNicoll, 2003; Haaga, 2001) .This theory was supported by some empirical studies such as those based on survey in Kenya .Family having a child death was approximately 30 percent higher than other parents in giving to the next birth (Gendell, 1981; Kimani, 2001; Rindfuss, Bumpass, & John, 1980).

My thesis is close to these above studies in attempts to find out the relationship between women's education and child mortality .

4 .Research objectives

This study, based on the information from the Censuses, has the following aims: first, to present an overall picture of the fertility and mortality situation in 1989, 1999 and 2009 in Vietnam; second, to examine how the partterns fertility and child mortality change in Vietnam over the period 30 years; and, third, to explore the role that the relationship of women's education with fertility and child mortality in Vietnam. The research questions are as follow:

1. What are the trend and pattern fertility and mortality in Viet Nam in 1989, 1999, and 2009, based on the Census samples?
2. What is the relationship of women's education with fertility and child mortality in Vietnam?
3. Whether the association with women's education and fertility and child mortality has changed over the period 30 years?

5. Data and variable construction

5.1 Data and sample

The objective of this study is to investigate the influence of women's education attainment on fertility and child mortality. In order to attend this purpose, I use the secondary data from the Census of Population and Housing in 1989, 1999 and 2009 **.** In particular, I use the sample of the census provided by IPUMS – International database **)**Minnesota Population Center – University of Minnesota **.(**

The census is conducted in Vietnam every decade at a specified time from the entire population .To date, the census was carried out 6 times in 1960, 1974, 1979, 1989, 1999, and 2009 in Vietnam (General Statistic Office, 2011; Kersten, 2010) .The purpose of the Census was to collect basic data on population and housing for the entire territory of the Socialist Republic of Vietnam, to serve national development

planning .The Population Census provides the fullest and most reliable picture of the country's population .Although there exist some limitations about sampling or method, The census is one of the most important sources of information that provides a basis for the official statistics of the country (Coleman, 2013).

To analyze the relationship between women's education and fertility, I use the data from Vietnam Population and Housing Census 1989, 1999 and 2009 .The sampling rate is 5**%**, 3 **%**and 15 **%**for the 1989, 1999, and 2009, respectively **.**Sample surveys in 1989 and 1999 represent the province, while the sample in 2009 represents the district **.**

Table 6: Sampling from CENSUS in 1989, 1999 and 2009

Year	**01/04/1989**	**01/04/1999**	**01/04/2009**
Total number of households	534,177	534,139	3,692,042
Number of persons	2,626,988	2,368,167	14,177,590
Percentage Sampling	5%	3%	15%
Number of women at childbearing age	116,153	263,601	2,098,186

Source : *Data census of Population and Housing 2009*

According to the Census of population and housing in 1989, 1999 and 2009 indicated, there were 2,626,988)in 1989(, 2,368,167)in 1999 (and 14,177,590) in 2009(individuals who were surveyed .Because the research question is related to women's fertility, this thesis only focuses on woman aged 15 to 49 who have ever given birth . The unit of analysis is women who were 15 to 49 years old in 1989, 1999 and 2009 . As a result, I select 116,153; 263,601 and 2,098,186 women who are at childbearing ages and have children at from 15 to 49 in 1989, 1999 and 2009 respectively .

5.2 .Construction of Measurements

This paper analyzes the association between)i (women's education and fertility, and)ii (women's education and mortality so that the main variables are fertility, mortality and women's education .In this part, I present how I measure the three main variables and compare them with some previous studies .

5.2.1 .Measures of fertility

Fertility is the actual level of reproduction of a population .Its measure depends on the number of live births, or a simple interpretation about how many children women have in during the childbearing age .(Palmore & Gardner, 1994) .Fertility is normally applied to women of childbearing age, usually defined as 15–49 years of age, although births to women outside this age range can, and do, occur. Furthermore, measuring fertility has connection with the number of live birth to a specific population and time reference period (Palmore & Gardner, 1994) .Fertility was measured from the number of children born to the child's mother .By convention, fertility is measured related to mothers (Pressat, 1988) .

To measure fertility of a population, a range of indicators, methods and models have been used, including total fertility rate, the crude birth rate) the number of live births per 1,000 population in a given year(, the crude rate of natural increase, age-

specific fertility rates and etc .(Palmore & Gardner, 1994; Wongboonsin, 2014) . Depending on what kind of data we have, we can use suitable methods .In the following part, I present some common methods that is implement in order to estimate fertility .

Firstly of all, the most widely used fertility measure of a population is the total fertility rates or TFR .TFR is defined as the average number of children that would be born to a woman by the time she ended childbearing if she were to pass through all her childbearing years conforming to the age-specific fertility rates of a given year (Kristi, 1996) .It is the best single measure to compare fertility across populations .TFR has the following formula :

$$\text{Total fertility rate} = \frac{\text{sum of age specific fertility rates} * (\text{age interval of women})}{1{,}000}$$

can also be written as

$$\text{Total fertility rate} = \frac{[\sum(\text{age specific fertility rates})](\text{age interval})}{1{,}000}$$

Source :(Palmore & Gardner, 1994) *.Measuring mortality, fertility, and natural increase :a self-teaching guide to elementary measures* :East-West Center

However, TFR stills has some drawbacks, such as TFR can not provided the real number of son or daughter that she have in all her life

In addition, another popular estimations which is used to estimate fertility of a population is based on the information about children ever born .The number of children ever born to a particular woman is an aggregate measure of her lifetime fertility experience up to the moment at which the data are collected .In the Census of Population and Dwellings in Vietnam in 1989, 1999 and 2009 data on children ever born can be obtained from questions regarding the number of children born alive to each woman .(Ewbank, 1985) .Depend on data children ever born) CEB(has three estimation methods .First is the method of the Brass which is based on comparison of cumulative age-specific fertility rates with reported average parities .Second is the estimate of age-specific fertility from the increments of cohort parities between two surveys. Third is the estimation of fertility from information on children ever born classified by duration of marriage (Ewbank, 1985; Gaisie, 1969; United Nations, 1983; Yi, Zhenglian, Zhongdong, & Chunjun, 2000)

In addition, another term is used related to child ever born is Completed Fertility Rate; it shows how many children on average a certain cohort of women who have completed childbearing actually produced during their childbearing years (Ward & Butz, 1980) .The number of children ever born is a measure of her lifetime fertility experience up to the moment at which the data are collected (General Statistic Office,

2010). The mean number of children ever born is computed as the ratio of the number of children born alive to all women in a particular age group to the number of women . In some case children ever born is calculated as :

$$CEB = \sum jP_j$$

Where j is the number of children and Pj is the proportion of women in that age group who have given birth to a total of j children. (Entwisle & Mason, 1985)

Nevertheless, the above measures of fertility are meant to capture fertility of a population but not at an individual level .As a result, for an empirical analysis, for example in this thesis, which relies on the variation of the individual level of fertility, the actual reported number of children ever born to specific women at the childbearing age is used..

In my thesis, I use data from census in 1989, 1999 and 2009 in Vietnam in order to estimate fertility .In particular, I use the information about children ever born .To be more specific, I use question 32 in questionnaire of the census .The question is "How many children do you have? "Depending on the age of the women, this question captures both incomplete and complete fertility .This question is used to ask women of ages 15 – 49 years old in each household to acquire on their reproduction histories .

Delivered women are those who have given births to live child)that is after delivering, the child shows at least one of alive signs such as :cry, breath, heartbeat, placenta cord move, etc(., not including stillbirths – died in mother's womb (General Statistic Office, 2010) .The next paragraphs will present the strengths and weaknesses of fertility estimation depend on data on children ever born in my study .

My study analyses methods of fertility estimation based on data about children ever born .Fertility in my thesis is estimated directly from information about child ever born .The advantage of this method is that fertility is directly calculated from data of the sample survey, so we can see the actual average number of children at the time of the survey .The average number of children ever born can be computed by dividing the total number of children borne by the women in the group by the total number of women in the group. Moreover, when child ever born variable are combined according to some other variable, such as region or age group, the variation in the average number of children ever born by group can be seen clearly.

On the other hand the estimation of fertility based on child ever born still has some drawback as follows .Firstly, with reference to the definition of child ever born is number of children ever born of women lifetime fertility experience up to the moment at which the data are collected, we still lack of information about timing of

the births such as “when children was born”. With no clearly defined time period, there is no provided information about the age of children .Secondly, some older women cannot remember the exact number of children that they have given birth, especially those who have died .Or they do not want to mention about child death because of personal reasons .Earlier studies observe that the proportion of the omission tends to increase with age of mother (Palmore & Gardner, 1994; Ware, 1984) . Therefore, the collected data may contain some errors .Thirdly, we never know about the fertility of women who died before the moment at which the data are collected because those who have died are particularly likely to be omitted (McN, 1984) .Another weakness is that the question about child ever born is expected to be reported by number, which may be subject to relatively greater errors than that of the information derived from questions with a simple "yes "or "no "response (Coleman, 2013) .In addition, this thesis uses secondary data from the Population and Housing Census of Vietnam in 1989, 1999 and 2009 which is provided by IPUMS **.**There are some limitations in this thesis related to the data, one of limitation is that this secondary data lack information about age of children so it is hard to distinguish whether child ever born includes adult children or not**.**

Table 7: Average number of children by interval childbearing age

Age group	Average child ever born		
	1989	1999	2009
15-19	1.14	1.06	1.09
20-24	1.44	1.27	1.28
25-29	1.99	1.72	1.58
30-34	2.77	2.32	1.98
35-39	3.55	2.85	2.32
40-44	4.20	3.40	2.63
45-49	4.95	3.91	2.92

Source :own calculate based on data census

Confirming with our intuition, a glance at the above table reveals some differences in children ever born to women in different age groups. There is a stable increase corresponding gradually by interval age .Such a pattern is observed for all three periods of the census .

5.2.2 .Measure of mortality

Mortality in demography is usually divided into child mortality and infant mortality .Measuring mortality has a connection with the number of death to a specific population and time reference period .As mention in literature reviews, infant mortality rate is cumulative incidence of death before 12 months of age .Infant mortality rates are estimated as the ratio between the number of deaths to children under age 1 per

1000 live births in one year divided by the total number of children born in that year (Caldwell, 1979b; McN, 1984; Palmore James A & W., 1994; Pressat, 1988; Stroobant, 2006) .IMR is usually measured as follow:

$$\text{Infant mortality rate} = \frac{\text{Deaths among children < 1 year old}}{\text{Number of live births in the same year}} \times 1{,}000$$

Meanwhile, child mortality is the number of dead children age under 5 per 1,000 live births in the years or the probability of dying between the 1st and 5th birthdays (Mwale, 2005; Palmore James A & W., 1994) .Therefore, child mortality rate is calculated as follow :

$$\text{CMR} = \frac{\text{No. of deaths of children from exact age one to less than age five during a given period}}{\text{Total no. of live births of newborns during the years of calculation}} \times 1{,}000$$

In general, there are two key concepts involving children mortality, i.e .child mortality and infant mortality .My thesis uses the data from the population and housing census in Vietnam in 1989, 1999 and 2009 that provided by IPUMS – International database)Minnesota Population Center – University of Minnesota(, which unfortunately lacks of information about age of child death .IPUMS only just supply the data on the number of children death .As a consequence, to distinguish between child mortality and infant mortality - whether child mortality is less than 5 years old or under 1 years old -is impossible to implement. Therefore, in my thesis, the concept

of child mortality is used and it implies both infant mortality and child mortality .I used information on the “number of child death” in data in order to estimate child mortality .The weakness of this estimation of child mortality based on the information about the number of child death is that some female may not want to mention about child death because of personal reasons .As a result, the collected data may contain some errors.

5.2.3 .Measure of women’s education

In the existing studies, there are various measures of education depending on the researcher purpose. However, education, sepecially martenal education, is normally conducted by the following four main ways. First is by the dichotomy between the illiterate and the literate. Second is by number of years of schooling completed. Third is by highest level of schooling attained (e.g., none, some primary, completed primary, some secondary, etc.). Fourth is by qualifications or degree obtained (e.g., no schooling, some schooling, school-leaving certificate, etc.). (Cronkhite, 1972; McBride, 1947; Ware, 1984).

Alternatively, another main way to estimate women's individual education relies on the number of years completed (Angrist & Krueger, 1991; McBride, 1947). To

be more specific to some studies, level of education is usually measured by many channels such as literacy, educational attainment or levels of education

According to guideline enumerator's manual 2009 of General Statistical Office, education is defined as follows (General Statistic Office, 2011).

1. ***Pre-primary education:*** This includes persons who are on the census day attending pre-primary schools or have completed pre-primary schools as the highest education level.
2. ***Primary education:*** This includes persons who are on the census day attending primary schools or have completed primary schools as the highest education level, consisting of:
   - Persons who have completed or ever-attended primary schools but not completed yet, and persons who were attending a grade of primary school and dropped out.
   - Persons who are attending any grade of primary schools.
3. ***Lower secondary education:*** This includes persons who are on the census day attending lower secondary schools or have attended lower secondary schools as the highest education level, consisting of:

- Persons who have completed or ever-attended lower secondary schools but not completed yet, and persons who were attending any grade of lower secondary school and dropped out.
- Persons who are attending any grade of lower secondary schools.

4. ***Primary vocational training:*** This includes persons who are on the census day attending or have completed primary vocational training schools or vocational training courses of less than 3 months as the highest education level.

Primary vocational training includes those who are attending or have completed vocational training courses of 3 months to less than 12 months (1 year).

5. ***Secondary education:*** This includes persons who are on the census day attending or have stopped going to secondary schools as the highest education level they achieved, consisting of:

- Persons who had completed or ever-attended secondary schools but not completed yet, and persons who have attended any grade of lower secondary schools but dropped out.
- Persons who are attending any grade of lower secondary schools.

6. ***Secondary vocational training:*** This includes persons who are attending or have ever-attended (including those who had completed and those who had ever-attended but dropped out) secondary vocational training schools.

Time duration of vocational training: It is from 1 to 2 school-years depending on the training field for persons who had completed secondary schools; from 3 to 4 school-years depending on the training field for persons who had completed lower secondary schools.

7. ***Secondary vocation:*** This includes persons who are attending or have ever-attended (including those who had completed and those who had ever-attended but dropped out) secondary vocational schools.

Time duration of secondary vocational schools: It is from 1 to 2 school-years for persons who had completed secondary schools; from 3 to 4 school-years for persons who had completed lower secondary schools.

8. ***High vocational training:*** This includes persons who are attending or have ever-attended (including those who had completed and those who had ever-attended but dropped out) high vocational training colleges.

Time duration of high vocational training: It is from 2 to 3 school-years depending on the training field for persons who had completed secondary schools;

from 1 to 2 school-years depending on the training field for persons who had completed secondary vocational training schools of the same training field.

9. ***High vocational education:*** This includes persons who on the census date are attending or have ever-attended (including those who had completed and those who had ever-attended but dropped out) high vocational education colleges.

Time duration of high vocational training: It is from 2 to 3 school-years depending on the training field for persons who had completed secondary schools; from 1 and half to 2 school-years depending on the training field for persons who had completed secondary vocational training schools of the same training field.

10. ***University/Bachelor:*** This includes persons who on the census date are attending or have ever-attended (including those who had graduated and those who had attended but dropped out) university education.

Time duration of university: It is from 4 to 6 school-years depending on the training field for persons who had completed secondary schools or secondary vocational education; from 2 and half to 4 school-years for persons who had completed secondary vocational education of the same training field; from 1 and

half to 2 school-years for persons who had completed high vocational education of the same training field.

11. Master: This includes persons who on the census date are attending or have ever-attended (including those who had graduated and those who had attended but dropped out) master-degree education courses.

Time duration of master education: It is from 1 to 2 school-years for persons who had completed university education.

12. Ph.D. (Doctor): This includes persons who on the census date are attending or have ever-attended (including those who had graduated and those who had attended but dropped out) Ph.D. (doctoral)-degree education.

Time duration of Ph.D. education: It is for 4 school-years for persons who had graduated from university; from 2 to 3 school-years for persons who had obtained master degree. In special cases, the time duration of Ph.D. education can be prolonged according to stipulations of the Minister of Education and Training.

Within the scope of this essay, women's education is measured by years of schooling and level of education by using data census. The reason why I use both of education indicators is because of two main reasons. On the one hand, level of education is used to explore each education strata that affects fertility. My

assumption is women who are primary schooling are more likely to have children than those with university schooling. On the other hand, to examine in more detail the impact of female schooling on fertility, I use years of completed schooling. The use of years of schooling enables me to evaluate the marginal impact of a year increase in education on fertility and mortality. For instance, basing on the coefficient we can see by how much fertility changes if there is an increase in one year of maternal education.

Data on level of education is extracted from the question 13, "What is the highest education level that you are attending or has completed" form the questionnaire of the Census Population and Housing in Vietnam. Meanwhile, years of schooling is calculated from the question 14, " What is the highest grade/year of education/training [NAME]" is attending or has completed at the above-mentioned level?" The data are collected as a continuous variable which represents the number of years of schooling for women.

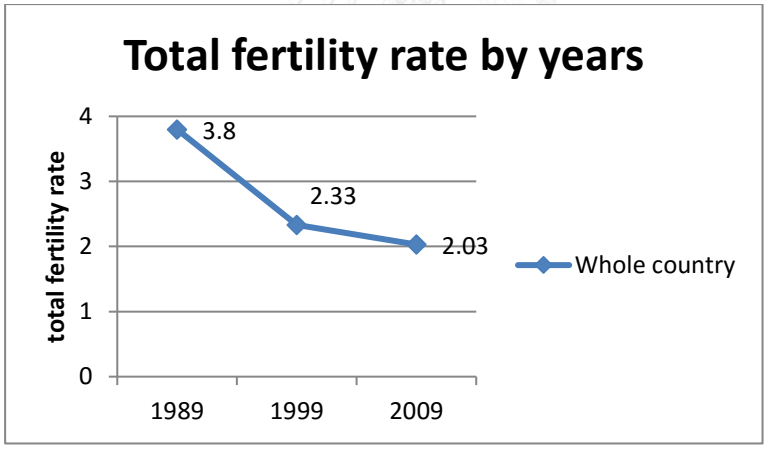
In summary, two indicators of education attainment are used in my thesis :years of schoolings and level of education .Women educational attainment is measured by the number of years of schooling and level of education which the women had completed by 1989,1999 and 2009 .

5.4 Descriptive statistics on fertility, child mortality and women's education.

Fertility and child mortality

In order to understand the general pictures of women's education and fertility and child mortality in the data used, the overview picture is provided in the following descriptive statistics. From Table 8, the summary statistics show that both the number of children ever born and children dead have declined over the three decades. This matches with the TFR and the trend in birth rates reported in Nguyen and Pham (2010).[1]

Figure 3: TFR of Vietnam from 1999-2009



[1] From Figure 3, according to Nguyen & Pham (2010) total fertility rate in Vietnam during the period 1989 - 2009 has plummeted from 3.8 children /woman in 1999 to 2.03 children/woman in 2009. The total fertility rates are relatively stable in recent years, but disparities between regions are quite large in Vietnam

In addition, the birth rate decreased continuously in Vietnam, the average number of children ever born dropped from 3.09 children in 1989 down 2.16 children in 2009. Child mortality rates also continued to decline from the average number of children die is 0.18 children in 1989 down to 0.04 children in 2009 (Nguyen & Pham, 2010).

Table 8: Average number of children in Vietnam in 3 years 1989(N= 116153), 1999 (N=263601), 2009 (N=2098186)

	1989		1999		2009	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Children ever born	3.03	2.005	2.58	1.511	2.18	1.112
Children dead	0.17	0.558	0.09	0.373	0.04	0.251

Source: Own calculation based on data Census 1989, 1999 and 2009

Moreover, by age, according to Table 8, fertility in Vietnam has changed significantly. There is a stable increase corresponding gradually by interval age, this figure is relatively evenly over 3 years. Childbearing age that gave births with smallest number is from 15-19 years old (1989: 1.14 children; 1999: 1.06 children; 2009: 1.09 children). And woman who is 45-49 years old, gave births with highest number (1989: 4.95 children; 1999: 3.91 children; 2009: 2.92 children)

Table 9: Average number of children by interval childbearing age

Year	Average child ever born			Average child dead		
	1989	1999	2009	1989	1999	2009
15-19	1.14	1.06	1.09	0.04	0.02	0.02
20-24	1.44	1.27	1.28	0.06	0.02	0.02
25-29	1.99	1.72	1.58	0.08	0.04	0.02
30-34	2.77	2.32	1.98	0.13	0.06	0.02
35-39	3.55	2.85	2.32	0.18	0.09	0.04
40-44	4.20	3.40	2.63	0.25	0.13	0.05
45-49	4.95	3.91	2.92	0.38	0.17	0.08

Table 9 covers the variation of child ever born and children dead by region. Vietnam has 63 provinces, divided into eight economic regions. Since 2006, it is divided into six economic regions (According to Decree No. 92/ND-CP 2006, the Northeast and Northwest regions become the Northern Midlands and Mountains; the North Central Coast and South Central Coast become North and South Central Coas). Data of the Censuses of Population and Housing 1989, 1999 and 2009 are based on 8 provinces. Then the variable region have been encrypted into six economic regions under Decree No. 92/ND-CP (General Statistic Office, 2010).

Table 10: Average number of children by region

	Child ever born			Child dead		
	1989	1999	2009	1989	1999	2009
Red River Delta	2.41	2.34	2.04	0.08	0.07	0.03
Northern Midlands and Mountains	2.76	2.46	2.09	0.11	0.08	0.05
North and South Central Coast	3.01	2.76	2.37	0.17	0.09	0.05
Central Highlands	3.12	3.04	2.50	0.18	0.13	0.06
Southeast	3.03	2.70	2.13	0.18	0.08	0.03
Mekong River Delta	3.34	2.55	2.04	0.17	0.09	0.03

Based on the three censuses of population and housing in Vietnam, it shows that fertility and mortality rates have decreased respectively every 10 years and reduced evenly across regions of the whole country. However, there is a more significant change in fertility in Mekong River Delta. While the average number of children ever born was the highest number in Vietnam by the year 1989 (3.34 children), it falls to its lowest level in 2009 (2.04 children). Another point worth mentioning is that "Central Highlands" and "North and South Central Coast" region still have fertility rates above replacement level in 2009 (2.50 children and 2.37 children), and child mortality also gets the highest number (0.06 children and 0.05 children)

Women's education

Table 11: Years schooling of women at childbearing in 1989, 1999 and 2009

Years of education	1989	1999	2009
Mean	6.70	7.67	8.03
S.D.	3.65	3.37	3.48

Figure 4: Level of education of women at childbearing in 1989, 1999 and 2009

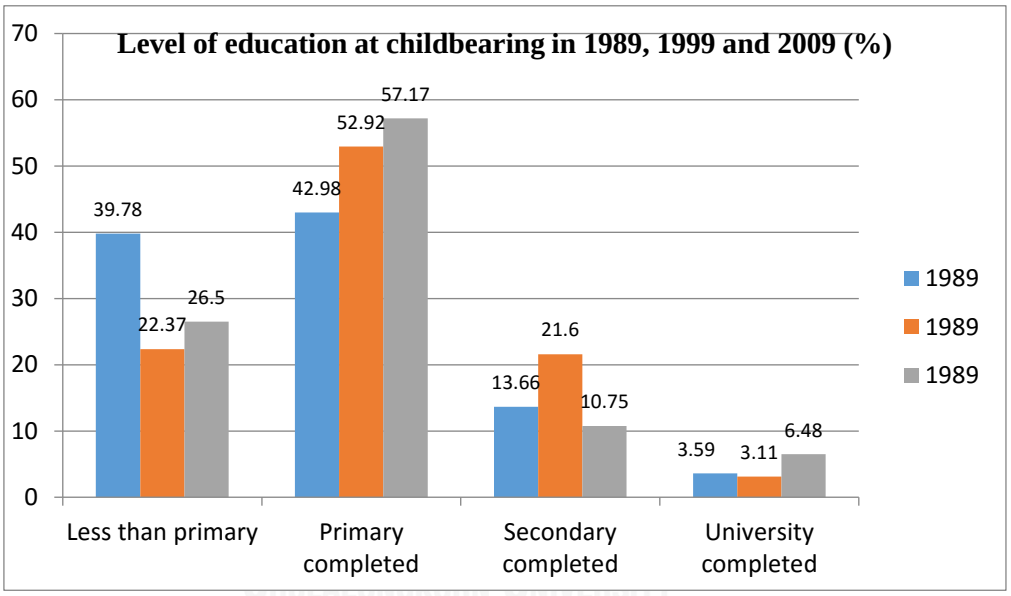


Table 11 and Figure 4 provide a general overview of the education background of women over the period 30 years. We can see that women's education increases over 30 years. The 2009 Population and Housing Census quantitatively reflects a very optimistic picture about universal education. "Less than primary completed" in 1989 was 39.78% and then decreased to 26.5% in 2009. However, the other level of

education such as: primary, university increase, from 42% to 57%, and from 3% to 6% respectively.

In addition, according to table 12 and table 1A and in the Appendix, it is found that the higher the level of education is, the lower the birth rate will be. Women who are educated at university always has the lowest birth rate, followed by the group at secondary level. Fertility of two groups is even lower than the fertility replacement at the year 1989. In 1989 and 1999, the highest fertility rates are with women who are educated "Less than primary" level. However, in 2009, the birth rate in this group also declines, which possibly shows the success in the population and family planning policy in intervening with the fertility of this group.

Table 12 : Level of women's education and fertility in 1989, 1999 and 2009

Level of education	1989		1999		2009	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Less than primary school	3.93	2.366	3.41	1.981	2.51	1.340
Primary	2.59	1.514	2.52	1.339	2.16	1.038
Secondary	2.00	1.153	1.94	.909	1.86	.847
University	1.98	1.026	1.80	.730	1.62	.628

6 .Empirical methodology

Four main empirical models will be employed to translate the below conceptual framework into the empirical analysis .

1. First model :the relationship between maternal level of education and fertility
2. Second model :the association between mother's years of schooling and fertility
3. Third model :the links between women level of education and child mortality
4. Fourth second :the association between mother's years of schooling and child mortality

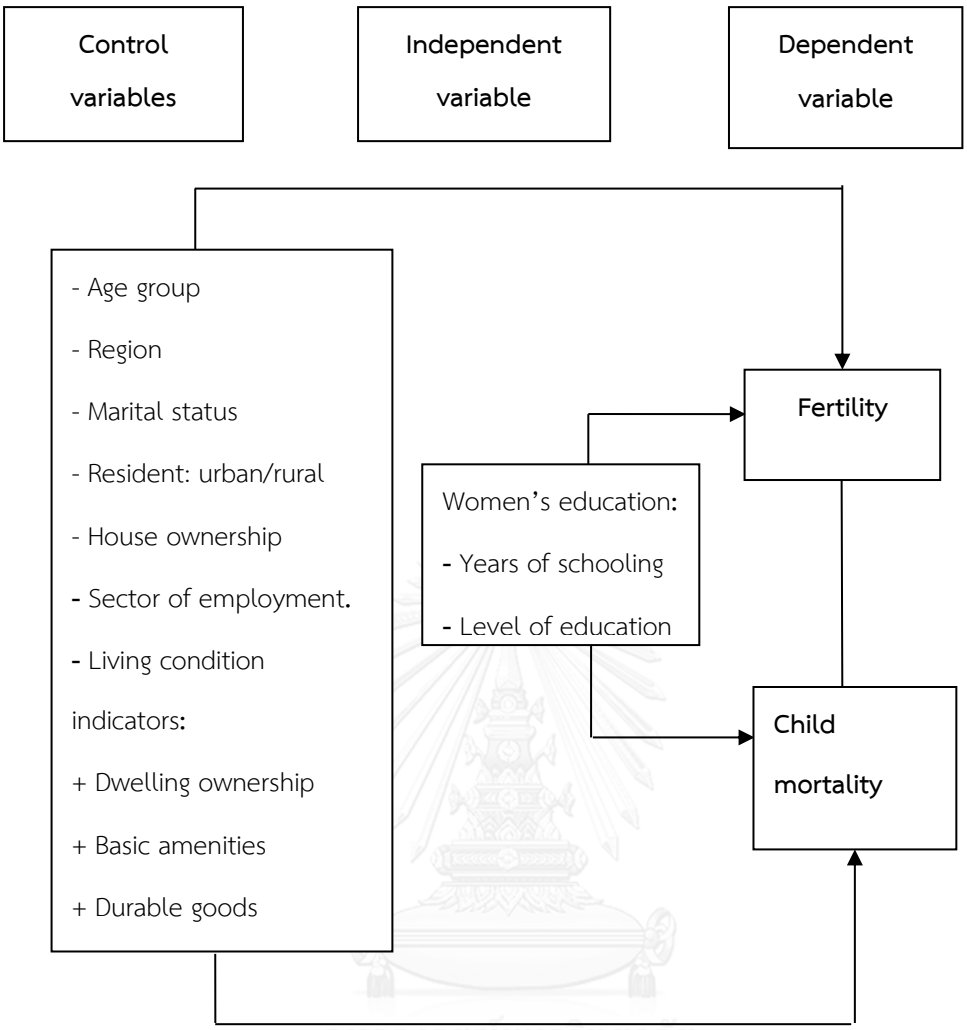
In doing so, I consider each year of the samples separately, thereby yielding three separate cross-sectional analyses .For each year of 1989, 1999, and 2009, the empirical model is as the following.

$$y_i = \alpha_i + \beta educ_i + \boldsymbol{\gamma' X_i} + \varepsilon_i$$

Where $\boldsymbol{y_i}$ is the measure of fertility (number of children)/ child mortality (number of child death) of each individual female in the sample. $\boldsymbol{educ_i}$ is the measure of women's education (level or years of schooling). $\boldsymbol{X_i}$ is a vector of control variables, including (i) age (to control for physical attributes and the timing of fertility), (ii) economic regions (to control for exogenous economic forces that may relate to fertility e.g. the southern regions are more economically advanced resulting in higher average income and employment), (iii) sector of workers (consider difference between private sector and public sector), (iv) migration, (v) basic amenities, (vi) where they live (urban or rural), and (vii) marital status.

CONCEPTUAL FRAMEWORK

Figure 5: Conceptual Framework of the relationship between women's education and fertility and child mortality



7 .Empirical findings

7.1 Level of education and fertility

In this part, I use regression model to assess the impact of level of maternal education on fertility. Analysis of the relationship between women's education and fertility is quite complicated by the fact that the direction of causation can run both ways. Within the ambit of this essay, I focus on the correlation between the level of women's education on fertility .Table 13 presents the association with level of education of women and fertility resulted from analyzing the sample that the respondents in this study were women age 15 to 49 in 1989)N =116153(, 1999)N=26360 (and 2009)N=2098186 .(As shown in table, for the first model, all education levels play important role in fertility, and higher level of education are lower fertility . It is also interesting to see that the coefficients of education levels increases as we go from primary to secondary and university .One explanation is that people with higher levels of education may concern about quality of children instead of quantity of children, so they tend to prefer small size family than others (McCrary & Royer, 2006) .The empirical results show that while women who have primary school are likely to have 0.7 smaller number of children that women less than primary education, women with university education are likely to have 1.5 smaller number of children than

women with less than primary education in 1989 .This illustrates that higher level of education has a much stronger effect on fertility than lower level of education, and this can be seen from the census sample over the three decades .Nevertheless, the empirical results also show that each additional level of education attained lead to the decrease fertility by approximately 0.5, 0.3 and 0.2 children in 1989, 1999 and 2009 respectively .This implies that by incremental, lower level of education, i.e .primary, has more correlational incremental impact on reducing fertility among the Vietnamese women than higher level of education such as secondary and university education . While higher level education delays marriage and hence period of having children, lower level of education equipped women with basic knowledge of how to read, write and calculate which could be crucial for women in obtaining and processing information and knowledge on fertility and contraception .

In addition, my analysis also shows that the influence of level of maternal education on fertility decreases in more modern periods. In 1989, compare to those who have less than primary school, those who have secondary school have about 1.1 smaller number of children. In 1999, compare to those with less than primary school, those who with secondary school have about 0.8 smaller number of children. It can be seen clearly that the gap in fertility between the most and the least educated

women notably decreases from 0.8, 0.4 to 0.2 children in 1989, 1999 and 2009 respectively.

After controlling for confounding factors, the research results show that there is still a statistical significant correlation between level of education and fertility (child ever born). From Table 13, there are statistically significant links between all control variables and fertility. Note that some control variables, namely owned housing, basic amenities, white goods, are not covered in the questionnaire in 1989.

Compared to people who are single, those who are married or widowed/divorced prefer have more children in 1999 and 2009. It is interesting to note that in 1989 women who are widowed or divorced are more likely to have smaller number of children than those who are single. One possible explanation is that in 1989 widowed or divorced people who are just suffer war in Vietnam, many of them have husband who died in war. They become women widowed without any children, even if having some villages bring name “widowed town” in Vietnam (Dung. P. X, 2014).

Regarding areas of residence, those living in the Red River Delta or Northern Midlands and Mountains have smaller number of children, compared to those living in southeast. In contract, women who are living in Central Highlands or North and South Central Coast are more likely to have more children than women who are

living in the southeast. Moreover, compared to those living in the rural area, those living in the urban area tend to have fewer children.

In addition, socio-economic variables are found correlated with fertility. For sector of employment, it is notable that women who work in other sectors have more children than those who work in public sector or as government officers. This may not be surprising because people who work at public sectors are controlled by two-child policy in Vietnam. They could not be have third and higher order birth. According to Decision No. 09, people who work for public service having third child or more shall be disciplined or is not promoted and consider taking out leadership positions. In addition, increasing the number of children leads to climb up form of discipline such as reprimand, warning, demotion and even dismissal (Committee for Population, 2003). Similar evidence is found in analysis number of children ever born and sector of employment. The highest number belong to group of women who are working in "Individual/family enterprise, and self-employed" sector (birth rate in this group was highest and persisted over 30 years). The average of number of children ever born of women who are working in "Public" sector has decreased slightly and decreased stability through 3 years (1989: 2.20 children; 1999: 1.94 children; and 2009: 1.69 children). Meanwhile, there is a dramatic and significant reduction of number of children of women who are working in

the "Private" and the "Collective or cooperative," declined from 3.57 to 1.64 children for the private sector, and declined from 3.14 to 1.91 children for the "Collective or cooperative" sector in the 30 years (See, Table A3 in the Appendix).

Table 13: Women's Education (Level of education) and Fertility

Child ever born	1989	1999	2009
Level of education (baseline for education is less than primary school)			
Primary	-0. 702	-0. 622	-0. 319
	(0. 011)***	(0. 005)***	(0. 001)***
Secondary	-1.136	-0.89	-0. 503
	(0. 015) ***	(0. 007) ***	(0. 002) ***
University	-1.532	-1. 025	-0. 442
	(0. 025) ***	(0. 015) ***	(0. 003) ***
Age group (baseline for age: 15-19 years old)			
Age between 20 and 24	0. 519	0. 497	0. 286
	(0. 043)***	(0. 023)***	(0. 0064)***
Age between 25 and 29	1.268	1.103	0. 652
	(0. 042) ***	(0. 023) ***	(0. 0063) ***
Age between 30 and 34	2.072	1.727	1.047
	(0. 0424) ***	(0. 023) ***	(0.0062) ***
Age between 35 and 39	2.87	2.279	1.387
	(0.0427)***	(0. 023)***	(0.0062)***
Age between 40 and 44	3.579	2.778	1.696
	(0. 0433) ***	(0. 023) ***	(0. 0062) ***

Age between 45 and 49	4.19	3.238	2.002
	(0. 0437) ***	(0. 023) ***	(0. 0063) ***
Region/area of living (baseline for region is Southeast)			
Red River Delta	-0.509	-0. 239	-0. 083
	(0. 016) ***	(0. 008) ***	(0. 0022) ***
Northern Midlands and Mountains	-0. 223	-0. 065	-0. 061
	(0. 018)***	(0. 007)***	(0. 0023)***
North and South Central Coast	-0.062	0. 067	0. 143
	(0. 015) ***	(0. 008) ***	(0. 0023) ***
Central Highlands	0.464	0.472	0. 362
	(0. 028) ***	(0. 011) ***	(0. 003) ***
Mekong River Delta	0.156	-0.291	-0. 298
	(0. 015)***	(0. 009)***	(0. 002)***
Urban	-0.239	-0.375	-0. 178
	(0. 011) ***	(0. 005) ***	(0. 001) ***
Marital status (baseline for marital status is single)			
Married	1.147	1.375	1.101

	(0. 040) ***	(0. 024) ***	(0. 008) ***
Divorced	-0. 059	0. 418	0. 466
	(0. 047)	(0. 028) ***	(0. 009) ***
Widowed	-0. 180	0. 602	0. 685
	(0. 045) ***	(0. 027) ***	(0. 009) ***
Sector of employment (baseline for sector of employment is Public)			
Private, not elsewhere classified	0. 834	0,2	0. 135
	(0. 394)	(0. 033) ***	(0. 004) ***
Individual/family enterprise, and self-employed	0. 256	0. 457	0. 334
	(0. 011)	(0. 006)***	(0. 002) ***
Foreign	-	0,066	0. 130
	-	(0,041)***	(0. 005) ***
Collective or cooperative	0.276	0. 484	0. 149
	(0. 013)	(0. 008) ***	(0. 015) ***
Mixed: public-private	-0. 390	0. 066	-
	(0. 140)	(0. 033)*	-
Owned housing	-	0.115	0. 090
	-	(0.010) ***	(0. 003) ***

Basic amenities	-	-0. 186	-0. 100
	-	(0. 006) ***	(0. 002) ***
White goods	-	-0. 007	-0. 042
	-	(0.004) ***	(0.001) ***
Migration	-		-0. 157
			(0.004) ***
Number of observation	116153	263601	2098186
R-Squared	0.4639	0.4505	0.3384

*Note: Standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively. Dependent variable is fertility which was measured by self-reporting number of children ever born.*

7.2 Years of schooling and fertility

In order to see the marginal effect of education upon fertility, I use the second model which explores the association between years of schooling and fertility. The results presented in Table 14, which illustrates that the contribution of years of schooling to fertility is statistically significant. Similar to the the results on the association between level of maternal education and fertility, years of schooling appears to be significantly and inverse correlated with fertility. For a one year increase in schooling, the number of children born fell remarkably by 0.139, 0.057 and 0.083 in

1989, 1999 and 2009 respectively. On the other hand, the association becomes attenuated after controlling for socioeconomic factors, but it remains strong and statistically significant. It thus points out that years of schooling is an important determinant of fertility. Nevertheless, women's education (years of schooling) have a more tightly relationship with fertility in the past. Nowadays this links seem to be decreasing in the context of more modernized Vietnam. Some studies suggest that women's educations are no longer key factors in contributing to the decline in fertility in recent years.

In order to take into account of some confounding effects of fertility, this table below presents the results of a multivariable analysis which attempts to control as many factors as the data allow. With regards to individual characteristics, several control variables are found to be correlated with fertility. These controls are age, region and marital status and etc. Concerning with demographic and socio-economic characteristics, the result shows that sector of employment, owned house, basic amenities, white goods have significant relationship with fertility.

Table 14 also illustrates a considerable regional variation in fertility. The analysis reveals that compare to those living in Southeast, those living in Red River Delta and Northern Midlands and Mountains more likely to have fewer children. It is interesting

to note that in contrast with women who are living in Mekong River region, women who are living in Southeast region have experienced a more dramatic fluctuation in fertility over three decades. In 1989 and 2009 fertility in Mekong River region is lower than Southeast region, but in 2009 fertility in Mekong River region is quite higher than Southeast region.

In addition, in the appendix, I complement the existing model with the model with the continuous age variable and age squared in order to further examine the relationship between fertility and age, while other control variables are kept. We can see from table A7 on page 71 that the coefficient of age squared is statistically significant and the relationship between age and fertility is not linear. While the coefficient of years of schooling are merely slightly changed, the coefficient of age changes because the additional age square variable. It is evident from table A7 that there is the positive coefficient for age and the negative for age squared. It means that fertility increase by age until a turning point is reached, after which point the function starts to decrease.

Table 14: Women's Education (Years of schooling) and Fertility

Child ever born	1989	1999	2009
Year of schooling	-0.139	-0. 083	-0. 057
	(0. 001) ***	(0. 0007) ***	(0. 0002) ***

Age group (baseline for age: 15-19 years old)			
Age between 20 and 24	0. 549	0. 485	0. 282
	(0. 043)***	(0. 024)***	(0. 00639)***
Age between 25 and 29	1.305	1.092	0.652
	(0. 0423) ***	(0. 0233) ***	(0. .00625) ***
Age between 30 and 34	2.110	1.717	1.040
	(0. 0422) ***	(0. 0232) ***	(0. 00623) ***
Age between 35 and 39	2.893	2.277	1.380
	(0. 042)***	(0. 0233)***	(0. 00623)***
Age between 40 and 44	3.591	2.787	1.689
	(0. 0430) ***	(0. 0233) ***	(0. 00624) ***
Age between 45 and 49	4.180	3.259	1.997
	(0. 0434) ***	(0. 0236) ***	(0. 00627) ***
Region/area of living (baseline for region is Southeast)			
Red River Delta	-0.506	-0. 303	-0. 061
	(0. 016) ***	(0. 009) ***	(0. 0024) ***
Northern Midlands and Mountains	-0. 214	-0. 127	-0. 049
	(0. 017)***	(0. 007)***	(0. 0022)***
North and South Central Coast	-0.061	-0. 038	0. 156
	(0. 015) ***	(0. 008) ***	(0. 0022) ***
Central Highlands	0.459	0. 433	0. 362
	(0. 028) ***	(0. 011) ***	(0. 003) ***
Mekong River Delta	0.124	0. 276	-0. 291
	(0. 015)***	(0. 009)***	(0. 0023)***
Urban	-0.194	-0. 385	-0. 171
	(0. 011) ***	(0. 005) ***	(0. 001) ***
Marital status (baseline for marital status is single)			
Married	1.165	1.363	1.103
	(0. 040) ***	(0. 024) ***	(0. 008) ***
Divorced	-0. 044	0. 409	0. 465
	(0. 047)	(0. 028) ***	(0. 009) ***
Widowed	-0. 203	0. 604	0. 685
	(0. 045) ***	(0. 027) ***	(0. 009) ***

Table 15: Women's Education (Years of schooling) and Fertility (cont.)

Child ever born	1989	1999	2009
Sector of employment (baseline for sector of employment is Public)			
Private, not elsewhere classified	0.741	0. 264	0. 016
	(0. 392)**	(0.034) ***	(0. 003) ***
Individual/family enterprise and self-employed	0. 241	0. 549	0. 176
	(0. 012)	(0. 006) ***	(0. 006) ***
Foreign	-	0.143	-0. 016
	-	(0.041) ***	(0.004) ***
Collective or cooperative	0. 269	0. 574	0. 044
	(0. 013)	(0. 007) ***	(0. 015) **
Mixed: public-private or parastatal	-0. 338	0. 126	-
	(0. 139)	(0. 033) ***	-
Owned housing	-	0. 118	0. 090
	-	(0. 010) ***	(0. 003) ***
Basic amenities	-	-0. 178	-0. 090
	-	(0. 006) ***	(0. 002) ***
White goods	-	-0. 005	-0. 025
	-	(0.004)	(0. 001) ***
Number of Observation	116153	263601	2098186
R-Squared	0.4639	0.4505	0. 3400

*Note: Standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively. Dependent variable is fertility which was measured by self-reporting number of children ever born.*

7.3 Level of education and child mortality

Table 15 shows child mortality differential among different education groups. The inverse relationship between level of women's education and child mortality could be seen. Compare to those who have less than primary school, those who have primary/secondary/ university have fewer number of children death. Overall, while level of women's education in 1989 and 1999 plays an important role in determining child mortality, level of maternal education in 2009 seems to have a smaller effect. Women who have university level of education have about 0.5 fewer child death than women who are less than primary school in 1989. However, at the same level of education (university) in 1999 and 2009 are more likely to have 0.1 and 0.03 fewer child death than those who are less than primary school respectively.

With regards to individual characteristics, age group, regions, marital status and residence have statistically significant correlation with child death. Women aged between 40 and 45 and aged between 45 and 49 are the groups with the highest number of child death compare to those under aged 15 to 19. Those living in the Red River Delta and Northern Midlands and Mountains are less likely to have child death compare to those living in the Southeast. While women who live in North and South Central Coast/ Central Highlands/Mekong River Delta are more likely to have children

death compare to those living in the Southeast. Likewise, it can be observed that those who are living in urban are less likely to have child death than those who are living in rural areas.

Regarding economic status, besides migration variable which shows very strong and significant effect on child mortality, occupation also appears to matter. Child mortality rate of mothers who are working in "Public" sector decreases only slightly and this reduction is steady over 30 years (decreased 0.02 children per year). Meanwhile, there is a more dramatic reduction in child mortality of women who are working in the " Private" and "Collective or cooperative" sectors (i.e. a reduction from 0.21 down to 0.02 children, and a reduction from 0.22 to 0.04 children, corresponding with the " Private" sector and "Collective or cooperative" sector from year 1989 to year 2009 (see Table 4A in the Appendix)). Women who have migrated are less to have child death compared to those have not migrated. Furthermore, white goods, basic amenities, and house ownership are also important determinants of the child mortality because these are condition to ensure better childcare.

Table 16: Women's Education (Level of education) and Child death

Child dead	1989	1999	2009
Level of education (baseline for education is less than primary school			
Primary	-0. 119	-0. 0888	-0. 027
	(0. 0039)***	(0. 0019)***	(0. 0004)***
Secondary	-0. 146	-0. 102	-0. 034
	(0. 0056) ***	(0. 002) ***	(0. 0006) ***
University	-. 532	-0. 108	-0. 030
	(0. 009) ***	(0. 004) ***	(0. 001) ***
Age group: (baseline for age: 15-19 years old)			
Age between 20 and 24	0. 040	0. 030	0. 001
	(0. 015)***	(0. 007)***	(0. 0018)***
Age between 25 and 29	0. 092	0. 057	0. 005
	(0. 015) ***	(0. 007) ***	(0. 0017) ***
Age between 30 and 34	0. 142	0. 082	0.013
	(0. 015) ***	(0. 007) ***	(0. 001) ***
Age between 35 and 39	0. 195	0. 115	0.026
	(0. 015)***	(0. 0075)***	(0. 0017)***
Age between 40 and 44	0. 279	0. 157	0.045
	(0. 015) ***	(0. 0075) ***	(0. 0017) ***
Age between 45 and 49	0. 391	0. 193	0. 068
	(0. 015) ***	(0. 0076) ***	(0. 001) ***
Region/area of living (baseline for region is Southeast)			
Red River Delta	-0. 064	-0. 0007	-0. 001
	(0. 005) ***	(0. 0029) ***	(0. 0006) ***
Northern Midlands and Mountains	-0. 054	0. 013	-0. 061
	(0. 006)***	(0. .0025)***	(0. 0023)***
North and South Central Coast	0. 001	0. 008	0. 012
	(0. 005) ***	(0. 0027) ***	(0. 00061) ***
Central Highlands	0.464	0. 104	0. 014

	(0. 028) ***	(0. 0037) ***	(0. 00062) ***
Mekong River Delta	0.156	-0. 003	0. 030
	(0. 015)***	(0. 003)***	(0. 0008)***
Urban	-0.239	-0.0408	-0. 016
	(0. 011) ***	(0.001)***	(0. 00065) ***

Table 17: Women's Education (Level of education) and Child death (conts)

Child dead	1989	1999	2009
Marital status (baseline for marital status is single)			
Married	1.147	0. 065	0.025
	(0. 040) ***	(0. 007) ***	(0. 0022) ***
Divorced	-0. 059	0. 040	0. 019
	(0. 047)	(0. 009) ***	(0. 0024) ***
Widowed	-0. 180	0. 045	0. 022
	(0. 045) ***	(0. 008) ***	(0. 0023) ***
Sector of employment (baseline for sector of employment is Public)			
Private, not elsewhere classified	0. 834	0. 021	0. 007
	(0. 394)**	(0. 011) ***	(0. 001) ***
Individual/family enterprise, and self-employed	0. 256	0. 029	0. 009
	(0. 011)	(0. 002)***	(0. 0007) ***
Foreign	-	0. 015	0. 006
	-	(0. 013)	(0. 001) ***
Collective or cooperative	0.276	0. 019	0. 002
	(0. 013)	(0. 002) ***	(0. 004) ***
Mixed: public-private or parastatal	-0. 390	0. 015	-
	(0. 140)	(0. 010)*	-
Owned housing	-	-0. 0004	-0. 0007
	-	(0. 0034) ***	(0. 0009) ***
Basic amenities	-	-0. 008	-0. 004
	-	(0. 002) ***	(0. 0005) ***
White goods	-	-0. 186	-0. 008
	-	(0. 0015) ***	(0. 0004) ***

Migration	-		-0. 001
			(0. 001) ***
Number of Observation	116153	263601	2098186
R-Squared	0.4639	0.0453	0.3384

*Note: Standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively. Dependent variable is child mortality which was measured by self-reporting number of children death*

7.4 Years of schooling and child mortality

Table 15 presents the results regarding the association between years of schooling and child mortality. After controlling for possible observable confounding factors, the research results show that there is a statistical significant difference in child death, between women who differ in education (years of schooling). The empirical result reveals some similarities with the above model that considers level of education. Form the previous section, there is a clearl difference in child mortality between those who have university's degree and those who hold high school diploma. However, from Table 16, we cannot see a large magnitude of the impact of a one year change in schooling. In particular, with one year increase in schooling, the number of child death falls by 0.004, 0.011 and 0.004 in 1989, 1999 and 2009 respectively.

Table 18: Years of schooling and Child death

Child death	1989	1999	2009
Year of schooling	-0.004	-0. 011	-0.004
	(0. 000) ***	(0. 0002) ***	(0. 000) ***

Age group (baseline for age: 15-19 years old)			
Age between 20 and 24	0. 0013	0. 029	0. 0013
	(0. 043)***	(0. 0076)***	(0. 0017)***
Age between 25 and 29	0.005	0. 059	0.005
	(0. 0423) ***	(0. 0075) ***	(0. 00172) ***
Age between 30 and 34	0. 013	0. 083	0. 013
	(0. 0422) ***	(0. 007) ***	(0. 00172) ***
Age between 35 and 39	0.026	0. 117	0.026
	(0. 042)***	(0. 007)***	(0. 00172)***
Age between 40 and 44	0.045	0. 159	0.045
	(0. 0430) ***	(0. 0075) ***	(0. 00172) ***
Age between 45 and 49	0.068	0. 197	0.068
	(0. 0434) ***	(0.007) ***	(0. 00173) ***
Region/area of living (baseline for region is Southeast)			
Red River Delta	-0.000	-0. 006	-0. 0000
	(0. 016) ***	(0. 0029) ***	(0. 0006) ***
Northern Midlands and Mountains	0. 014	0. 0069	0. 014
	(0. 017)***	(0. 0025)***	(0. 00061)***
North and South Central Coast	0. 015	0. 0060	0. 015
	(0. 015) ***	(0. 0027) ***	(0. 00062) ***
Central Highlands	0.459	0. 099	0. 030
	(0. 028) ***	(0. 003) ***	(0. 0008) ***
Mekong River Delta	0.124	-0. 001	-0. 015
	(0. 015)***	(0. 003)***	(0. 0006)***
Urban	-0.194	0.040	-0. 171
	(0. 011) ***	(0.001)***	(0. 001) ***
Marital status (baseline for marital status is single)			
Married	1.165	0. 065	0.025
	(0. 040) ***	(0. 0079) ***	(0. 0022) ***
Divorced	-0. 044	0. 039	0. 019
	(0. 047)	(0. 009) ***	(0. 0024) ***
Widowed	-0. 203	0. 046	0. 022
	(0. 045) ***	(0. 008) ***	(0. 0023) ***

Table 19: Years of schooling and Child death (cont.)

Child death		1989	1999
Sector of employment (baseline for sector of employment is Public)			
Private, not elsewhere classified	0.741	0. 021	-0. 003
	(0. 392)**	(0. 011) ***	(0. 001) ***
Individual/family enterprise, and self-employed	0. 241	0. 030	-0. 004
	(0. 012)	(0. 002) ***	(0. 0006) ***
Foreign	-	0. 017	-0. 006
	-	(0. 013) ***	(0. 001) **
Collective or cooperative	0. 269	0. 018	-0.006
	(0. 013)	(0. 002) ***	(0. 004)
Mixed: public-private	-0. 338	0. 016	-
	(0. 139)	(0. 010) ***	-
Owned housing	-	-0. 0006	-0. 0007
	-	(0. 003) ***	(0. 0009) ***
Basic amenities	-	-0. 003	-0. 003
	-	(0. 002) ***	(0. 0005) ***
White goods	-	-0. 016	-0. 007
	-	(0. 001)	(0. 0004) ***
Number of Observation	116153	263601	2098186
R-Squared	0.4639	0.0454	0. 3400

*Note: Standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively. Dependent variable is child mortality which was measured by self-reporting number of children death.*

8 .Conclusion and recommendation

8.1 Discussions

The role of maternal education within the family has long been admitted as a key factor in determining fertility and mortality .Most of the literature provides strong evidence that women's education continues to play an important role in decreasing fertility and mortality in many countries around the world (Caldwell, 1979a; Kravdal & Rindfuss, 2008; Martin, 1995; Rindfuss et al., 1980) .This pattern is found, in this essay, in Vietnam in 1989, 1999 and 2009 by analyzing data from Census population and housing in three decades .My study attempts to describe the inverse relationship between women's education and fertility and mortality in Vietnam .

The results reveal that women's education attainment has an inverse association with fertility and child mortality. Women with higher levels of education are more likely to have fewer children than those with lower level of education. Meanwhile, for an increase in women's education (years of schooling) by one year, the number of child born falls by 0.05 children and the number of child death drops by 0.004 child in 2009. This could possibly be seen as partly the results of two key national policies: education policy and family planning policies in Vietnam.

Firstly, descriptive statistics shows that women's education increases significantly from 1989 to 2009, especially at primary school level. It is a result of the remarkable efforts of the government to implement education policies over a long period. Education has always been seen as a vital national policy. Terms 35 of the Constitution of Vietnam (published in 1992) defines education as a priority of national policy. In 1991, the Government of Vietnam issued General Primary Education law, confirmed the responsibility of government to provide free and forced primary education for all children in Vietnam (Binh., 2005). Before 1975 education policy emphasizes general education, especially illiteracy eradication programs in the North of Vietnam, This policy are applied the whole country after 1975. Since the Doi Moi policy was implemented in 1986, education systems in Vietnam made important changes. Overall, these changes tend to increase resources, both private and public investment in education at all levels (Ministry of Education and Training, 1992). In addition, the national budget for education has increased steadily each year (figure 2) (Ministry of education and training, 2014). All above efforts contribute to growth the proportion of women's education in Vietnam.

Secondly, in most regions in Vietnam, the fertility difference between uneducated and highly educated women appears to have decrease over the time. The

gap between lower and higher maternal education in fertility is increasingly narrow partly and possibly because of the success of population and family planning policy in Vietnam. After 1961 Vietnam started to apply population and family planning policy, in 1988, the National Committee for Population - Family Planning enacted two child policies. As a result, the total fertility rate fell dramatically from 5.25 in 1975 to 2.33 children in 1999 (Goodkind, 1995; Hoa et al., 1996) and this policy continues until this day. The application of education policy and family planning policies in Vietnam increase level of education and decrease fertility. Furthermore, fertility decline is seen as a general trend in countries around the world (Bongaarts, 1999; Feeney, 1994) and Vietnam is not different. In southeast region, especially Ho Chi Minh city TFR is 1.4 lower than the replacement level in 2009 and according to the forecast it may be lower. Therefore fertility decrease combined with increase universal education may help close the gap in fertility among women who are with different levels of education.

In addition, my result is similar to existing studies with evidence from other countries; women who have higher education are more likely to have fewer children (Breierova & Duflo, 2003; Cochrane, 1979; Lesthaeghe et al., 1985) .This is because education can affect to age at marriage, delay marriage, and improve knowledge and

attitude that relates to reproduction and fertility (Becker, 1960b; Cochrane, 1979; Smith, 1996) .

However, it is interesting to note that sector of employment become one of the factors that impact on fertility .The results show that those who are working at public sector have the number of children less than those who are working at private / individual/foreign /collective or cooperative sectors .This can be explained as follows : According to Decree 114/2006/ND-CP, party members or civil servants)public sectors (who have a third child or more shall be disciplined with many different forms .In addition, two child policies is applied strictly with those who work in the public sector, leading to fertility decline in this group .

Results of regression analysis also indicate that there is a discrepancy in education between those who live in Central Highlands and those who live in southeast .Women in mountainous areas have lower education and higher fertility than women who stay in developed areas .Compare with Martin)1995(, in some of the least developed countries women usually have low mother's education and tend to have more children .In some developed regions, the economic development has always gone along with the development of human capital .For instance, the educational reform programs in Vietnam is aimed primarily at schools in big cities or priority

economic sector (Duggan, 2001 ; Martin, 1995) .This explains why in developed economic regions such as south or red river delta always have the percentage of women's higher education, compare to underdeveloped areas .From literature review, this trend is also found in many regions around the world include Latin America, Kenya and Iowa (Kimani, 2001; Palloni & Rafalimanana, 1999; Smith, 1996)

Regarding the association with women's education and child mortality, the findings suggest that women's education have inverse association with fertility as well as child mortality. In addition, sector of employment, region, and marital status, white goods, basic amenities, owned housing and migration are also key determinants of child mortality. The results show that individuals with university's degree or higher education are less likely to have child death, compared to those with less than lower secondary education.

Regarding to sector of employment, the finding shows that women who are working in Individual/family enterprise and self-employed have the highest child mortality among all sectors. In contrast, those who work in public sector have the lowest child mortality. Indeed today, the government's policies in many fields are only powerful for the public sector. Meanwhile, it is difficult to access policies for those in other areas of employment. This result reflects the real situation in Vietnam. Women's

groups that are working in individual/self-employed sector usually have difficulty in accessing to family planning program, contraception or the national program on child care. As a consequence, the proportion of child death in these groups is at the top of all sectors of employment. (Thang & Anh, 2002)

Moreover, my research also discovers that child mortality increases with the age of the women in Vietnam. The average number of child death of those who are between 45 and 49 years old is highest, compare to other age group. There are two principal reasons for this. It is irrefutable fact that the older women have more children and hence higher chance of having their children died. Beside, one point which I believe to be absolutely pivotal is the fact that the general healthcare in Vietnam is less advanced at the time when these older women have kids. Women who are 49 years old in 1989 born in 1940, which means that they could be having a kid in 1958. In this time the war was occurring in North and South of Vietnam until 1975, some of their children may be died because of the war. And the healthcare system is not adequately invested because of political instability (Gates, 1990)

8.2. Limitation

Nonetheless, there are some potential limitations in this thesis**.** By using secondary data from the Population and Housing Census of Vietnam in 1989, 1999 and

2009 that does not directly aim to answer research questions related to fertility, there is a lack of some variables that also have high effect to fertility such as income, family planning, desire of women's education and contraception. Education and uneducated women differ in terms of knowledge, socioeconomic status and attitude. One of the most possible determinant of fertility is contraception, which the questionnaire does not provide the information. Also as we know that education can affect the knowledge about contraception or how to take care of children; if these variables are correlated to education, then the results on education may be biased and inconsistent.(Coleman, 2013)

In addition, according to some existing studies, there is a problem of endogeneity between women's education and fertility .Omitted unobserved characteristics such as attitudes can influence both education and fertility .In addition, simultaneity between education and fertility can occur .To have children at the early age)early and higher fertility (could reduce education. However, in this study, I only evaluate the relationship between women's education)level of maternal education and years of schooling (on fertility)number of children ever born(, and do not address the endogeneity problem of education.

Although Vietnam has the mid-term survey census in 2014, I cannot approach to obtain this data set .Because in June 2015 Vietnam Statistical Office has not yet finished entering data, and they did not provide data the mid-term Population and Housing Census of Vietnam in 2014.

Furthermore, data which are supplied by IPUMS lacks the information about age of child dead and child born. So the distinction between child mortality and infant mortality, i.e. whether child mortality is less than 5 years old or less than 1 years old, cannot be implemented. In addition, based on such data, I cannot identify whether the term children used in the dataset inculdes adult children or not.

Besides, it will be interesting to investigate the relationship between women's education and children education. However, at the moment, the dataset does not allow me to pair-match mothers with children. As a result, I cannot analyses the relationship between children education and maternal education

Lastly, further limitation is the splitting, merging administrative units, regions over 30 years causing some difficulties in the classification accuracy of the analysis unit .Thus, there may be some minor deviations in the indicators of calculated targets study .

Obviously the statistical results cannot tell us what kind of school or education that makes a difference in fertility behavior, despite the inclusion of other major determinants of fertility in the analysis. We can only conclude that level and years of formal education and schooling have some contribution towards fertility and child mortality, but cannot say about what factors inside formal education that matters.

8.3 Recommendation

This thesis presents an updated overview of the association between women's education and fertility as well as child mortality. It confirms that enhancing women's education is one of the factors associated with a decline in fertility and mortality

. Educated women have lower fertility and mortality than uneducated women. Although we should be undisputed that there are numerous other factors which may be influencing the fertility and child mortality.

According to the literature, the pattern of increased women's education that leads to a decline in fertility is also found in many regions and over time. Education is not only a human right but also a human capital. The association between women's education and fertility and child mortality is clear and pervasive enough to warrant policy attention. A large body of research substantiates that women's education is a powerful agent of social change and social justice as well sustained fertility.

Maternal Education is believed to influence fertility through several different ways. Schooling promotes change in the traditional roles and status of women. Differences in the level of education show clear differences in fertility of women. During the period of time 1989 to 1999, the fertility and child mortality differences in accordance to the differences in the level of women's education have similar trends. Increasing maternal education leads to decreasing fertility as well as child mortality. Meanwhile, there is a significant narrowing gap difference between level of women's education and fertility and child mortality in 2009. Specifically, a one level increase in education, child ever born just falls by 22.6% and child death drops by 1.61% in 2009. Whereas, the rate is quite high in 1989 and 1999 (approximately 50% for child ever born and child survive, and nearly 6% for the child death.)

Under the pressure and the impact of industrialization, modernization, economic and social development leading to the powerful spread of modern lifestyles, empowering women in social development, combined with the cultural differences between regions can increase the difference in fertility among women with different exposer to these changes. There is a strong decline in fertility in the southern provinces. The proportion of women who have delayed marriage, have children late and have fewer children and the proportion of women who are infertility is growing.

The cost of raising children increases compared with the income, while the value of children in the contemporary social environment is declining. These factors can also cause the trends of decreasing fertility (Ministry of Health, 2011).

The trend of fertility decline is happening at a fast pace and remained stable over many years in Vietnam. Meanwhile, international experience indicates that once fertility has decreased to low level, the policy of fertility encouragement with the huge cost almost has no impact on rebounding birth rate (in most cases, it is rebounding to 1.8 children per woman) and it is impossible to restore back the replacement level (2.1 children per woman) (Mason, 2005; Rodolfo A. Bulatao, 2001).

The child mortality rate in the "Central Highland" and "North and South Central Coast," is the highest in the country. Therefore, it may be possible to conclude that more attention should be paid to the health care of mothers and children for this region. Before the complex evolution of fertility corresponding to the education and culture of each region sets in, Vietnam may want to build their own policies that are appropriate to each area to maintain a stable and reasonably low fertility, particularly for the region with relatively high birth rate, or with greater than the replacement level. Reducing the gap in fertility between regions could possibly mean reducing the gap in socio-economic development, equitable development, and sustainability.

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REFERENCES

APPENDIX

VITA

I work as a teaching assistance at Faculty of Sociology - University of Social sciences and humanities Ho Chi Minh city, Vietnam. I hold a Bachelor's Degree, and Master's Degree in Sociology. I graduated in 2007, from then until now I have worked at two universities such as Ton Duc Thang University, Social sciences and humanities in Ho chi Minh city, Vietnam. I also worked at Research Institute and Non-governmental organizations. From work processing, I got experience in research about the issues such as social network for worker, HIV-infected children. elderly.... I am particularly concerned about gender inequality and social networks

Appendix:

Table A1: Average number of children ever born by education and region

	Less than primary			Primary			Secondary			University		
	1989	1999	2009	1989	1999	2009	1989	1999	2009	1989	1999	2009
Red River Delta	3.70	3.01	2.42	2.46	2.45	2.13	1.87	1.87	1.82	1.95	1.81	1.61
Northern Midlands and Mountains	3.95	3.17	2.45	2.61	2.51	2.08	1.89	1.87	1.75	2.00	1.79	1.60
North and South Central Coast	3.85	3.53	2.77	2.66	2.66	2.35	2.10	2.15	2.03	2.08	1.90	1.66
Central Highlands	4.43	3.80	2.95	2.78	2.79	2.39	2.25	2.34	2.02	2.34	2.06	1.78
Southeast	3.77	3.34	2.52	2.65	2.46	2.05	2.13	2.03	1.73	1.92	1.77	1.58
Mekong River Delta	3.86	3.17	2.26	2.63	2.15	1.86	2.12	1.89	1.60	1.82	1.64	1.49
Total	3.85	3.32	2.48	2.59	2.50	2.13	2.00	1.96	1.83	1.98	1.81	1.61

Table A2: Average number of children dead by education and region

	Less than primary			Primary			Secondary			University		
	1989	1999	2009	1989	1999	2009	1989	1999	2009	1989	1999	2009
Red River Delta	0.20	0.12	0.05	0.08	0.07	0.03	0.04	0.03	0.02	0.04	0.02	0.01
Northern Midlands and Mountains	0.23	0.15	0.08	0.09	0.08	0.04	0.04	0.04	0.03	0.04	0.02	0.02
North and South Central Coast	0.29	0.15	0.08	0.12	0.08	0.04	0.06	0.04	0.03	0.03	0.03	0.02
Central Highlands	0.35	0.26	0.12	0.12	0.08	0.05	0.09	0.05	0.03	0.08	0.02	0.02
Southeast Mekong River Delta	0.27	0.14	0.06	0.12	0.07	0.03	0.06	0.04	0.01	0.07	0.03	0.01
Total	0.28	0.13	0.04	0.13	0.06	0.02	0.07	0.04	0.02	0.03	0.02	0.01
	0.27	0.14	0.06	0.10	0.08	0.03	0.05	0.04	0.03	0.04	0.03	0.01

Table A3: Average number of children by differing in sector of employment

	Average child born		
	1989	1999	2009
Public	2.20	1.94	1.69
Private	3.57	2.12	1.64
Individual/family enterprise, and self-employed	3.34	2.68	2.29
Mixed: public-private or parastatal	2.24	1.63	-
Collective or cooperative	3.14	2.72	1.91
Foreign	-	1,47	1.55

Table A4: Average child dead by differing in sector of employment

	Average child dead		
	1989	1999	2009
Public	0.06	0.04	0.02
Private	0.21	0.07	0.02
Individual/family enterprise and self-employed	0.22	0.09	0.04
Mixed: public-private or parasternal	0.12	0.03	-
Collective or cooperative	0.18	0.09	0.03
Foreign	-	0.02	-

Table A5: Average number of children by differing in sector of employment

	Average child born			Average child survive			Average child dead		
	1989	1999	2009	1989	1999	2009	1989	1999	2009
Public	2.20	1.94	1.69	2.14	1.90	1.67	0.06	0.04	0.02
Private	3.57	2.12	1.64	3.36	2.05	1.62	0.21	0.07	0.02
Individual/family enterprise, and self-employed	3.34	2.68	2.29	3.12	2.59	2.25	0.22	0.09	0.04
Mixed: public-private or parastatal	2.24	1.63	-	2.12	1.60	-	0.12	0.03	-
Collective or cooperative	3.14	2.72	1.91	2.96	2.63	1.88	0.18	0.09	0.03
Foreign	-	1,47	1.55	-	1.45	1.53	-	0.02	-

Figure A1: Normal distribution of women's age in 1989

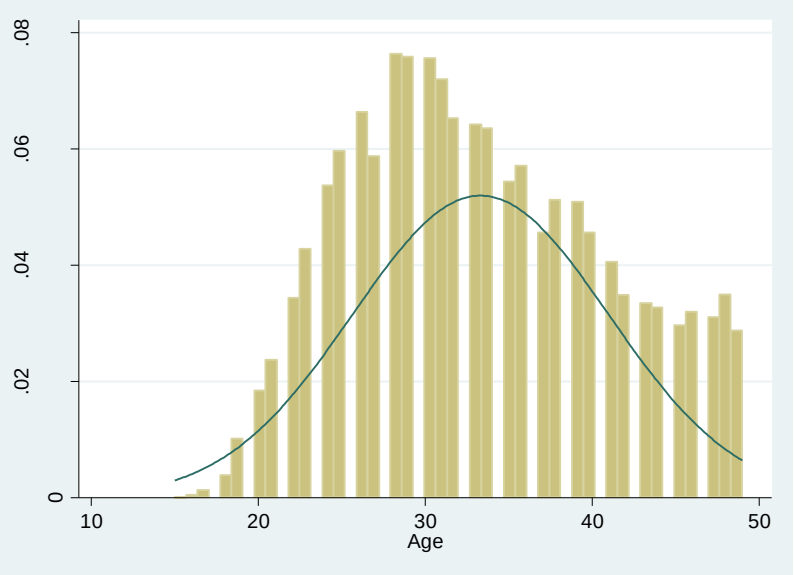

Figure A2: Normal distribution of women's age in 1989

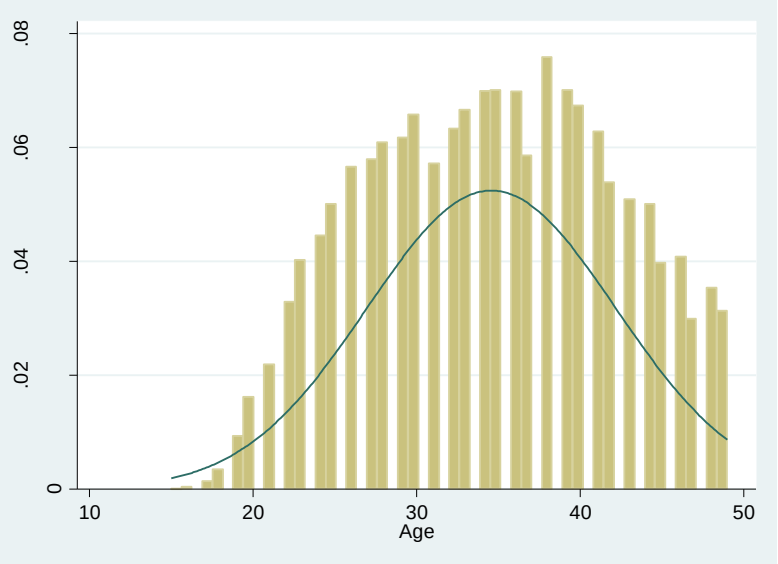

Figure A3: Normal distribution of women's age in 1989

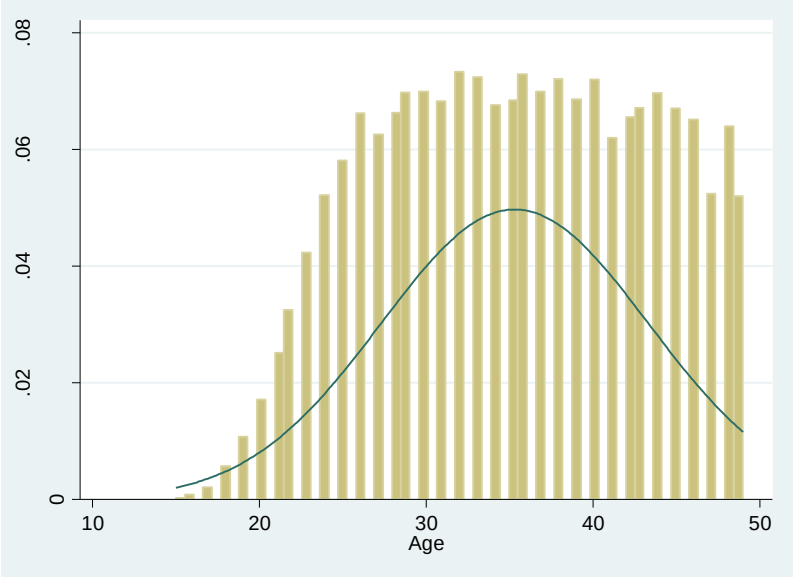

Table A6: **Years of schooling and fertility**

	1989	1999	2009
Year of schooling	-0.138	-0. 083	-0. 056
	(0. 001) ***	(0. 0007) ***	(0. 0002) ***
Age	0.231	0. 183	0.106
	(0. 004) ***	(0. 002) ***	(0. 0006) ***
Age square	-0.001	-0.0009	-0.0005
	(0.000)	(0.000)	9.86e-06
Region/area of living (baseline for region is Southeast)			
Red River Delta	-0.516	-0. 305	-0. 064
	(0. 015) ***	(0. 008) ***	(0. 0023) ***

Northern Midlands and Mountains	-0. 220	-0. 125	-0. 047
	(0. 017)***	(0. 007)***	(0. 0022)***
North and South Central Coast	-0.064	-0. 035	0. 154
	(0. 015) ***	(0. 008) ***	(0. 0022) ***
Central Highlands	0.61	0. 437	0. 365
	(0. 028) ***	(0. 011) ***	(0. 003) ***
Mekong River Delta	0.132	0. 278	-0. 292
	(0. 014)***	(0. 009)***	(0. 0023)***
Urban	-0.202	-0. 390	-0. 173
	(0. 011) ***	(0. 005) ***	(0. 001) ***
Marital status (baseline for marital status is single)			
Married	1.144	1.363	1.102
	(0. 399) ***	(0. 024) ***	(0. 007) ***
Divorced	-0. 070	0. 409	0. 460
	(0. 046)	(0. 028) ***	(0. 008) ***
Widowed	-0. 255	0. 604	0. 670
	(0. 044) ***	(0. 027) ***	(0. 008) ***

Sector of employment (baseline for sector of employment is Public)			
Private, not elsewhere classified	0. 716	0. 272	0. 023
	(0. 388)**	(0.033) ***	(0. 003) ***
Individual/family enterprise and self-employed	0. 247	0. 556	0. 178
	(0. 011)	(0. 006) ***	(0. 024) ***
Foreign	-	0. 170	-0. 006
	-	(0. 041) ***	(0.004) ***
Collective or cooperative	0. 247	0. 581	0. 045
	(0. 011)	(0. 007) ***	(0. 015) **
Mixed: public-private or parastatal	-0. 335	0. 146	-
	(0. 138)	(0. 033) ***	-
Owned housing	-	0. 117	0. 088
	-	(0. 010) ***	(0. 003) ***
Basic amenities	-	-0. 180	-0. 091
	-	(0. 006) ***	(0. 001) ***
White goods	-	-0. 010	-0. 030
	-	(0.004)	(0. 001) ***
Number of Observation	116153	263601	2098186
R-Squared	0.4741	0.4564	0. 3473

*Note: Standard errors are in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively. Dependent variable is child mortality which was measured by self-reporting number of children death.*