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THE DETERMINANTS OF FERTILITY IN SOUTHEAST AND SOUTH ASIAN COUNTRIES: AN ANALYSIS OF PANEL DATA 2003-2008

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Abstract

The fertility rate in Southeast and South Asia is relatively high compared to other region in the world, but the trend tends to decrease rapidly. This paper aims to quantitatively explore the factors influencing fertility rate in Southeast and South Asia by applying econometric model of the panel data. Applying the fixed effect estimation method on the 2003-2008 panel data, this study found that the infant mortality rate is an important factor influencing the high fertility rate in this area. The high elasticity of infant mortality rate implies that parents cover their risk from losing children by producing more children. Surprisingly, the demand for children (fertility rate) follows the demand of normal goods in which one digit increase in log income per capita will increase the fertility rate by 0.334 births per woman.

Keywords: Fertility, Infant Mortality, Demand for Children, Demographic

JEL : J11, J13, J18, J19

I. INTRODUCTION

Southeast and South Asia[1], where almost 30 percent of the world population are living, have a unique demographic characteristic. The prominent demographic characteristics in this region are both high fertility and high infant mortality rate, but the trend tends to decrease rapidly. Total fertility rate for Southeast Asia in the late 1980s was 3.8 births per woman while in 2008 the fertility rate was 2.3 births per woman.

[1] Countries included in Southeast Asia are Indonesia, Malaysia, Singapore, Philippines, Thailand, Viet Nam, Laos, Myanmar, Cambodia and Brunei Darussalam, while countries included in South Asia are India, Sri Lanka, Maldives, Nepal, Pakistan, Afghanistan, Bhutan and Bangladesh.

During this period, the fertility rate in this region has declined by almost 1.5 births per woman. Recent data shows that between 2003 and 2008, the fertility rate has decreased 0.3 births per woman and the infant mortality rate also has declined 19 child deaths per-thousand births (under-five infant mortality rate) in Southeast Asia. While in South Asian countries, by 2003 the fertility rate was 4.29 births per woman and it decreased by 1 birth per woman during this period. Moreover, under-five infant mortality rate has also decreased sharply from 102.5 per thousand births (2003) to 81.63 per thousand births (2008)[2].

According to the survey conducted by Hirschman and Guest (1990) in four Southeast Asian countries (Indonesia, Malaysia, Philippines and Thailand), the declining of fertility rate was caused by several factors such as postponed marriage, increasing coverage of access to quality reproductive health services, declining infant mortality rate, family structure, increasing adult education level particularly for female as well, cultural tradition and religious beliefs. This finding supports The Demographic Transition Theory that socioeconomic factors change the incentives for childbearing (Hirschman, 1994). The rapid development in Southeast Asia and South Asia has changed the economic structure from the agricultural based to an industrial based, which led to a rapid decreasing of fertility rate in this region. In the past, children were viewed as the source of labor force in agriculture activity therefore families bore more children to help them in the agricultural production.

In Southeast and South Asia, a rapid social development in education and health has also been observed over two decades. Adult literacy rate and health indicators are surprisingly high in this area. Most research findings in human fertility behavior frequently observed that there is a negative correlation between parent's education, especially female education, and fertility rate. Higher female education will correlate with higher opportunity to get good jobs, better salary and higher career advances, however it will also increase the opportunity cost for bearing children. On the other hand, the improvement of health indicators such as increasing the number of doctors, hospitals and midwives will massively reduce infant mortality rate. A low infant mortality rate indicates a low risk of losing children before they grow up. Therefore, the parents may reduce the demand for children, which leads to less fertility rate.

The rapid change in economic development in this region has also increased income per capita and the standard of living. During the five years period, income per

[2] UNESCAP Population Data Set, accessed in 10 April 2010.

capita of Southeast Asian countries has increased by more than 27 percent or 5.4 percent per year. Meanwhile, the growth rate of income per capita in South Asian countries is 6 percent annually. Higher income indicates the family has higher ability to support children. If we were to view a child as a normal good, then increased income will increase the demand for children and the increased cost of raising children will reduce the demand for children. Therefore, macroeconomic variables such as income per capita and cost might be important factors for household/family's decision on demand for children.

The empirical study on the fertility rate in South and Southeast Asia are relatively scarce both in numbers and in variation of methodologies. The study conducted by Hirschman and Guest using non-parametric method/descriptive analysis has found sources of declining fertility rates but they could not find which factor most influenced the declining rate. This paper aims to explore the important factors that influence the determinants of fertility rate in South and Southeast Asia by utilizing econometric model of panel data. This study focuses on Southeast and South Asian countries, because they have a fairly rapid social and economic development, a relatively similar economic structure and unique demographic characteristics. In addition, this study will also briefly elaborate policy recommendations such as access to public health care in order to decrease fertility and infant mortality rates.

The next section reviews the economic theories of fertility and previous researches addressing fertility issues and it will be continued to present an econometric model and an estimation procedure of panel data to estimate the fertility rate. The fourth section analyzes the determinants of fertility rate in this region. Finally, this study proposes policies how to reduce fertility rate and infant mortality rate.

II. THE THEORETICAL FRAMEWORK

II.1 THE ECONOMIC THEORIES OF FERTILITY

Becker (1960) said that for most parents, children are viewed as durable goods, primarily a consumer's durable, which yields money income, satisfaction, to parents. Therefore, the theory of the demand for consumer durables is also a useful framework for analyzing the demand for children. Becker argued that demand for children is determined by income, child costs, knowledge, uncertainty and tastes. De Tray (1973) viewed that children are viewed as home-produced durable assets from whom parents consume a flow of child services such as satisfaction and happiness. Households can increase their production of child services either by increasing the numbers of children

(quantity) or by increasing the resource investment (quality) in existing children.

Turke (1989), using an evolutionary theory, concluded that social and economic success has almost led to an increased in reproductive success. It has been widely accepted as a theoretical framework that the change of human fertility occurs through changes in three variables: supply of children, demand for children and cost of fertility regulation. Hirschman (1994) summarized that there are two major economic approaches to the study of fertility change. First is the ''new home economics'' approach, which is the application of microeconomic theory to family issues, including fertility. The second approach is the synthesis of economic and sociological theories of fertility presented in the supply and demand framework of Richard Easterlin.

Following the first approach, it will be derived the demand for children. Let's assume there are only two goods, child (X_c) with the price P_c (opportunity cost) and child (X_g) with the price P_g and the family income is exogenous variable (Y). A family utility function follows Cob Douglass Utility Function ($U(X_c, X_g) = X_c^{\alpha} X_g^{\beta}$). Then the family will optimize their utility subject to budget constraint.

$$\underset{X_c^{\alpha}, X_g}{Max}\, U(X_c, X_g) = X_c^{\alpha} X_g^{\beta}$$

subject to $P_c X_c + P_g X_g = Y$

$$L = X_c^{\alpha} X_g^{\beta} + \lambda(Y - P_c X_c - P_g X_g)$$

$$X_c = \frac{\alpha Y}{(\alpha + \beta) P_c}$$

$$X_g = \frac{\beta Y}{(\alpha + \beta) P_g}$$

From the maximizing utility, X_c is the Marshallian demand for children as a function of income and opportunity cost. Higher income will increase the demand for children, whereas opportunity cost will lower demand for children.

II.2 PREVIOUS RESEARCH ON FERTILITY ISSUES

The quantitative study of the determinants of fertility has received much attention in the demographic research for many decades. Friedlander and Morris (1967),

using the cross section data of 85 countries[3], explored the economic, social, political, and cultural determinants of fertility behavior in different countries. They found the positive and statistically significant relations between fertility and illiteracy, child mortality, proportion of agricultural population, proportion of nonfarm self employment, and overcrowded housing. They also showed a significant negative relationship between fertility and communism. Heer (1966), utilizing data collected from 41 nations during the 1950's, found that fertility is directly associated with per capita income when controls for other relevant variables are instituted. On the other hand, per capita newspaper circulation as index of education and infant mortality are inversely related to fertility.

Yamada (1984) studied the dynamic relationship between two demographic variables--the infant mortality rate and the fertility rate-- using time series methodology. This study found that infant mortality and fertility are not independent but rather jointly determined. A decline in infant mortality that is due to an increase in real income per capita triggers a subsequent decline in fertility. Ainsworth et al. (1996) observed the impact of women's schooling on fertility and contraceptive's use in fourteen Sub-Saharan African Countries. They found that female schooling has a negative and statistically significant relationship with cumulative fertility in all of the countries, in both urban and rural areas.

Al Qudsi (1998) estimated the impact of cultural and economic factors on the demand for children based on data collected from Arabic countries. Fertility is a function of real GDP per capita, rate of urbanization, infant mortality rate and female education. The obtained results strongly support the hypothesis that cross-country heterogeneity buttresses differentiated fertility and that female education mitigates high fertility. Child mortality and parents' preferences for sons positively affect fertility[4]. In addition, demand for children is price and income inelastic.

Panopoulou and Tsakloglou (1999) examined the relationship between fertility and socioeconomic variables within a cross-country framework. The empirical results showed that fertility is negatively related with female education, urbanization and family planning but is positively related with the levels of infant mortality and economic development. No significant relationship was found between fertility and female labor force participation.

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[3] The data collected for this study are confined to the period of the late 1950's and early 1960's

[4] The son preference can reduce fertility since sex selective abortion leads to female fetus being aborted.

According to the previous researches, it can generally be concluded that the fertility rate is inversely related to female education and ratio of urban population. Conversely, it is positively correlated with infant mortality rate and economic development particularly an increase in per capita income.

III. MODEL, DATA AND ESTIMATION METHOD

III.1 ECONOMETRIC MODEL

According to the economic theory, previous researches, and available data, this study proposes an econometric panel data model for estimating the fertility rate in Southeast and South Asia. The use of this panel data allows us to control unobservable country-specific characteristics that may be correlated with fertility behavior. Some variables may be country invariant or time invariant that may affect fertility. Other variables may be hard to obtain and their omission leads to bias in the resulting estimates. Panel data are able to control for these countries and time invariant variables whereas a time series or cross section study cannot do. In general, failure to condition on these unobservable will result in inconsistent estimates of the coefficients of these variables (Baltagi, 1995). Examples of factors that are unobservable in our data but could induce country heterogeneity include country differences in the distribution of income among households and according to geographic location.

According to the Marshallian Demand Function, if children are viewed as normal goods, then the income per capita should be positively correlated with demand for children while cost of raising children should be negatively correlated with demand for children[5]. It is assumed that a current income per capita and a current consumer price index do not directly influence the demand for children but there is a two-year time lag. This assumption is based on the fact that a normal pregnancy period is approximately nine months. Therefore, the current condition of income and price will influence the fertility rate in the next year or two years later[6].

In addition to economic variables, this model also includes other social variables such as child mortality rate, female education, and ratio of urban population. A child mortality rate should be positively correlated to the fertility rate. A high child mortality rate implies that parents will cover their risk of losing children by producing more children. On the contrary, an increase in female education will lower fertility rate

[5] The demand for children in this research refers to the fertility rate.

[6] For technical convenience reason, income per capita is converted in to logarithm value.

because high female education correlates with a high opportunity cost of having children. In addition, the shift of the economic structure from agricultural field to industrial or service field will lower the fertility rate. Therefore, the ratio of urban population should negatively influence the fertility rate.

The theoretical panel data model is shown as follow:

$y_{it} = \alpha_i + \beta_i' x_{it} + \varepsilon_{it}$ (i = 1,2,…,n, t=1,2,…,T),

Where

y_{it} = a dependent variable

x_{it} = vector of independent variables

ε_{it} = error term i.i.d $E(\varepsilon_{it}) = 0$, $E(\varepsilon^2{}_{it}) = \sigma_\varepsilon^2$, $\{\varepsilon_{it}\}$ and $\{x_{it}\}$ are independent

it = the i-th country at time-t

Based on theoretical model above, it proposes a panel data model for estimating the determinants of fertility rate in Southeast and South Asian countries as follow:

$$TFR_{it} = \alpha_i + \beta_1 IMR_{it} + \beta_2 SER_{it} + \beta_3 URB_{it} + \beta_4 \log(PERCAP_{it}(-2)) + \beta_5 CPI_{it}(-2) + \varepsilon_{it}$$

Table 1. Variable explanation

No.	Variable	Symbol	Data Explanation
1	Fertility Rate	TFR	Total fertility rate per woman
2	Infant Mortality Rate	IMR	Under five mortality rate (per 1000 birth).
3	Female Education	SER	Gross Secondary Enrollment Ratio by Female (per cent)
4	Income per-capita	PERCAP	Income per-capita (US$) (in logarithm value)
5	Price	CPI	Consumer Price Index
6	Urban Population	URB	Ratio between urban population and total population (per cent)

Source: Author

III.2 ESTIMATION METHODS

There are three approaches for estimating the coefficients in the panel model: pooled estimation, fixed effect, and random effect. The choice of estimation method depends on the treatment on the individual effect (α_i), which is taken to be constant over time *t* and specific to the individual cross-section unit *i*. If we take α_i to be the same across all units, then ordinary least squares/pooled estimation provides consistent and efficient of α and β. The fixed effect approach takes α_i to be group specific constant term in the regression model. The random effect approach specifies that α_i is a group specific disturbance, similar to ε_{it} except that for each group, there is but a single unit that enters the regression identically in each period (Greene, 2000).

Since this study would like to know the individual country effect, the possible estimation method is either a fixed effect or a random effect. Both of the approaches treat the individual effect (α_i) to be individual/country specific so the outcome of α_i will be different across all country. Greene (2000) stated that the fixed effect model is a reasonable approach when we are confident that the differences between cross section units can be viewed as parametric shifts of the regression function. This model might be viewed as applying only to the cross-sectional unit in the study, not to additional units outside the sample. In other settings, it might be more appropriate to view individual specific constant term as randomly distributed across cross-sectional units. This view will be appropriate if we believe that the sample of cross sectional units was drawn from a large sample population.

The estimation method of the fixed effect states as follows:

$$y_{it} = i\alpha_{it} + X_{it}\beta + \varepsilon_{it} \qquad \text{(i = 1,2,…,n, t=1,2,…,T),}$$

or in a vector form

$$y = D\alpha + X\beta + \varepsilon$$

Where D is the nT x n matrix of dummy variable. This model is usually referred as the Least Square Dummy Variable (LSDV) model, which can be estimated using OLS estimation. The OLS estimator of α and β are as follow:

$$\beta = \left[X'M_d X\right]^{-1}\left[X'M_d Y\right],$$
$$M_d = I - D\left(D'D\right)^{-1}D',$$
$$\alpha = \left[D'D\right]^{-1}D'\left(y - X\beta\right),$$

The estimation method of the random effect states as below:

$$y_{it} = \alpha + \beta' x_{it} + u_i + \varepsilon_{it},$$

Where u_i is the random effect specific to the i-th country. We assume that $\{u_i\}$ and $\{\varepsilon_{it}\}$ are independent. We have

$$\sum{}^{*} = Var(u_i + \varepsilon_i) = \begin{bmatrix} \sigma_u^2 & \cdots & \sigma_u^2 \\ \vdots & \ddots & \vdots \\ \sigma_u^2 & \cdots & \sigma_u^2 \end{bmatrix} + \begin{bmatrix} \sigma_\varepsilon^2 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \sigma_\varepsilon^2 \end{bmatrix}$$

This model is estimated by Generalized Least Squared (GLS). The GLS estimator of $\gamma' = (\alpha, \beta')$ is:

$$\hat{\gamma}_{GLS} = \left(X^{*'} \sum{}^{*-1} X^{*}\right)^{-1} X^{*} \sum{}^{*-1} Y$$

Where, $X^{*} = [e, X]$, e is the NTx1 vector of ones, and $\sum{}^{*} = I_N \otimes \sum$

We apply the Hausman Test to check whether the fixed effect or the random effect is an appropriate estimation method for this data. The Hausman test is:

$H_0 =$ $E(u_i | x_{it}) = 0$ (Random Effect)

$H_1 =$ $E(u_i | x_{it}) \neq 0$ (Fixed Effect)

If the $\chi^2_{statistic}$ is larger than $\chi^2_{k,\alpha}$, then H_0 can be rejected. It means the fixed effect will result unbiased and efficient estimator.

III.3 DATA SET

The Southeast Asian countries included in this study are Indonesia, Malaysia, Thailand, Philippines, Vietnam, Cambodia and Laos. South Asian countries are India, Pakistan, Afghanistan, Bangladesh and Sri Lanka. This study cannot include all the countries in Southeast and South Asian region due to the differences in social and

economic structure and also available data.

This study mostly utilized the ESCAP population data set from 2003 to 2008 published by United Nations Economic and Social Commission for Asia and the Pacific and also The Human Development Report publications published by United Nations for Development Program (UNDP). In 2006, there were no publications of Gross Secondary Enrollment Ratio. Therefore, the extrapolation method is applied to substitute the missing data. To complete the data set, especially for macroeconomic variables such as income per capita and consumer price index, this study utilizes other sources such as Asian Development Bank, World Bank, ESR U.S Department of Agriculture and individual country's publications.

IV. THE DETERMINANTS OF FERTILITY RATE

IV.1 THE PANEL ESTIMATION OF FERTILITY's DETERMINANTS

The Hausman test shows that the value of Chi-Square=16.63 (p-value=0.005) is larger than the critical value therefore there H_0 (random effect) can be rejected based on the aforementioned fact. The fixed effect estimated with the Least Square Dummy Variable (LSDV) will give a minimum variance/efficient estimator[7]. The LSDV estimation result is as below:

$$TFR_{it} = 1.351 + 0.018*IMR_{it} - 0.021*SER_{it} - 0.018*URB_{it} + 0.334*LOG(PERCAP_{it}(-2)) - 0.001*CPI_{it}(-2)$$

(1.66) (37.77)*** (-6.43)*** (-2.31)** (2.70)** (-2.12)***

N= 48, F Stat=108725, R-squared= 0.9982, S.E. of Regression= 0.0742

****=significant at 1% level, **=significant at 5% level, *=significant at 10% level*

Figures in parenthesis are t-statistic.

[7] The estimation results satisfy statistical requirements and econometric assumptions. However, DW statistic (1.402) is relatively low indicating there is a serial correlation in this estimation. However, we have difficulties to omit this problem in the panel model.

Table 2. Country/individual effect[8]

Cambodia = -0.715	*Indonesia = -0.104*	*Laos = 0.019*
Malaysia = 0.773	*Philippines = 1.678*	*Thailand = -0.751*
Viet Nam = -0.006	*Afghanistan = 0.375*	*Bangladesh = -0.188*
India = -0.723	*Pakistan = -0.431*	*Sri Lanka = 0.112*

Source: Author's calculation

According to the LSDV result, all variable signs fit with the theoretical foundation in which the infant mortality rate and income per capita are statistically significant and positively increasing the fertility rate. On the other hand, the consumer price index, female secondary enrollment ratio and urban population ratio are inversely and significantly related to the fertility rate. A positive income per capita and a negative consumer price index show that children can be viewed as normal goods in the household utility function. Therefore, the application of microeconomic theory is suitable in analyzing fertility issues. These findings support the previous researches done by Becker (1960), Heer (1966), Friedlander and Morris (1967), and Rosenzweig (1977), Yamada (1984), Hirschman and Guest (1990), Hirschman (1994), Ainsworth et al. (1996), Al Qudsi (1998), and Panopoulou and Tsakloglou (1999).

IV.2 SOCIO-ECONOMIC INDICATORS AND FERTILITY RATE

Infant Mortality Rate

According to the estimation result, infant mortality rate (under-five mortality rate) is an important factor influencing the increase in fertility rate in Southeast and South Asian countries. When infant mortality rate increases by one child, it will increase fertility rate by 0.018 births per woman. This result shows that the household behavior is risk averse. A high infant mortality rate means a high risk of child's death before growing up. If the households/parents are rational agents, they will reduce their risk by producing more children. Having more children will increase the chance to raise a healthy child highly. If children are viewed as an investment good, the act of producing more children will reduce their risk.

[8] Table 2 shows that Philippines has the highest country effect while India has the lowest country effect. If all independent variables in all country are same or under *ceteris paribus* condition, the fertility rate in Philippines is the highest in this region.

High infant mortality rate is positively correlated with malnutrition of children, low number of doctors, birth unattended by midwives, no access to health services, remote areas, uneducated parents, and poverty. In remote area where most poor and uneducated people live, the births usually have common characteristics like no access to health facilities and lack of midwife services in which is exactly meant by quality reproductive health services. A high infant mortality rate sometimes is followed by a high mother mortality rate and vice versa. The family without a mother will reduce the ability to raise and to bear children. Therefore the chance of losing children will be higher. This condition is known as ‘’Death Trap’’.

Female Education

The coefficient of female secondary enrollment ratio is equal to -0.021 which means one percentage point increase in female secondary enrollment ratio will decrease fertility rate by 0.021 births per woman. Higher female education will raise the female average marriage age because they have to spend three years to complete junior or senior high school. Female marriage age will shorten productive time for producing babies. Moreover, higher female education will correlate with a higher opportunity to get good jobs, good salary and higher career advances, therefore it will increase the opportunity cost for bearing children.

The more educated female are, the more rational they will be. Consequently, they will consider more aspects in advance such as income, cost of bearing children, future child education before they decide to have children. The female education also correlates indirectly with lowering fertility rate through a positive externality of education. An educated female has more understanding of health issues, which will lower infant mortality rate but result in a lower fertility rate. Michael (1973) had observed the negative correlation between household education and fertility that more educated couples achieved greater contraceptive efficiency.

Ratio Urban Population

The change of economic structure from an agriculture based to an industrial/service based industry which is shown by a negative urban population coefficient also leads to a decreasing fertility rate. One percentage point increase in urban population will reduce fertility rate by 0.009 births per woman. In order to survive in urban area, both male and female parent need to work in order to satisfy basic needs. Therefore, having more children in urban area will increase both direct costs such as meals, education, babysitter and maid, and also an opportunity cost especially

for working mother.

The urban community is usually more concerned with quality of children rather than quantity of children. They will produce fewer children and allocate more resources to increase living qualities for their children. A high ratio of urban population also indicates an economic activity concentrated in urban area. Consequently, it will reduce demand for worker in rural area and it will be followed by a decreasing fertility rate in rural area. This finding is also similar to Rosenzweig's study (1977). Using U.S aggregate data covering the period from 1939-1960, he concluded that the importance of the reduction in the value of children as productive assets in agriculture as a factor in the post war decline in the U.S farm birth rate.

Income Per Capita and Consumer Price Index

The fertility rate (demand for children) follows the same demand for normal goods in which the income per capita and consumer price index are both positively and negatively influencing the demand. One digit increase in log income per capita will increase the fertility rate by 0.334 births per woman. However, the current per capita income and consumer price index are not related to the current fertility rate. There are two years lags between fertility rate and per capita income as well as consumer price index. It means that the 2008 total fertility rate was influenced by the 2006 income per capita and consumer price index. If the parents and the couples consider the current income and price as important factors for reproduction and marriage decision, then there will be at least more than one year lag from the time decision to child birth.

Based on the microeconomic theory of consumer behavior, the Marshallian demand for a normal good is increasing in income and decreasing in price. Higher income means higher ability to support child bearing. Therefore, they will demand/consume more children to raise their utility. Moreover, in Islamic countries, a man is able to practice polygamy as long as he fulfills the following requirements: 1) provide money to support each of his family, 2) obtain permission from his first wife, and 3) spend equal amount of time and money on each family. Consequently, an increase in income can lead to polygamy practice that will increase fertility rate.

On the other hand, the consumer price index as an indicator for the cost of raising children has a negative relationship with fertility rate. An increase in consumer price index without an income growth will decrease purchasing power of a society in which the family income will not be enough to support child bearing. The sharply increase in price could also influence the couple's decision to postpone marriage since

the budget might not be enough to cover expenses of wedding ceremony. As a rational agent, the household/family will consider its expected income and expected price change in the future before they decide to have children.

IV.3 POLICY IMPLICATION

Lowering fertility rate through increasing access to quality reproductive health services is still an important policy for developing countries that mostly have limited resources to provide essential public goods such as education, health, and job opportunities. Fewer children mean healthier and well-educated families as well as reduced government burdens to allocate budget on widening access of health and education services. Fewer children also mean households can allocate more resources to education and health care for the child.

According to the sign of coefficient from panel data estimation, lowering fertility rate can be achieved through reducing infant mortality rate, promoting female school enrollment ratio, increasing urbanization, lowering economic growth and promoting inflation. The last three choices are not feasible to be implemented because all policy makers have an objective to increase social welfare through promoting higher economic growth, lower inflation and balancing between rural and urban development. Moreover, since urbanization has a minimal impact on reducing fertility, policy should focus on improving health and educational services in the rural area. Therefore, the possible choices for lowering fertility rate are both implementing low infant mortality rate and promoting female school enrollment ratio policies. If the governments face a budget constraint, they can choose the first policy.

It should be remembered that the proposed policies for lowering infant mortality rate must have a solid basis both theoretically and empirically. In order to provide empirical evidence for a basis of proposing efficacious policy, this study utilizes a simple linear regression to determine the important factors which can massively reduce infant mortality rate (IMR). This regression applies on the cross section data of Asian Countries which is drawn from Human Development Report 2007/2008[9]. Even though, there are many variables that may influence IMR, due to the available data, this study only includes three independent variable: ratio of immunization for measles (IMUN), ratio of births attended by skilled health personal (BAHP) and per capita health expenditure (PHEXP).

It is expected that all independent variables have a significant negative

[9] http://hdr.undp.org/en/media/HDR_20072008_EN_Complete.pdf

correlation. High ratio of immunization can reduce under-five mortality rate because immunization can provide immunity for children to fight against diseases. In addition, births attended by skilled health personal can lower mother mortality rate, which is directly related to lower infant mortality rate. The presence of mother will increase the ability to raise children in the family. Moreover, the country with high per-capita health expenditure has the ability to provide better health facilities and services therefore the relationship between per capita health expenditure and under-five mortality rate should be negative.

The OLS estimation of cross section data can be found below:

*IMR = 108.004 - 0.342*IMUN - 0.388*BAHP - 0.024*PHEXP*

(2.44) (-0.568) (-1.931)** (-2.711)**

N= 38, F-Statistic = 11.646, S.E of Regression= 22.108, R-Squared = 0.5068

**= significant at 5% level, **= significant at 10% level*

Figures in parenthesis are t-statistic.

This finding shows that the birth attended by skilled health personal (BAHP) and per capita health expenditure (PHEXP) are an important factor for reducing the under-five infant mortality rate. Promoting midwife vocational school and nursing vocational school to increase a number of health professional and widening health care accesses will reduce under-five mortality rate by 0.388 child deaths per 1000 birth. Allocating more budgets on health sector will also directly reduce the mortality rate by 0.024 child deaths per 1000 birth. Surprisingly, immunization (IMUN) is negatively reducing infant mortality rate but not statistically significant. It might be caused by a large variance of data so this variable is still important to be considered and cannot easily be neglected in reducing infant mortality rate.

According to Human Development Report 2007/2008, the average of birth attended by skilled health personal in Asian Countries (38 countries) is around 76.86 per cent. However, it is found that the birth attended by skilled health personal in countries like Bangladesh, Nepal and Timor-Leste is still below 20 per cent. This study strongly suggests that those countries which ratio is still below 50 per cent should speed up the number of skilled health personal. It can be achieved through promoting midwife vocational schools and nursing vocational schools.

However, it should be remembered that the main problem in most of the

developing countries including country in Asia-Pacific region is that people rely more on the traditional midwives rather than the professional midwives to assist childbirth. To overcome this problem, government should promote the cooperation between the traditional midwives and the professional ones. In addition, government can provide training for the traditional midwife in order to improve the standard operating procedure in assisting childbirth in a proper and hygienic way.

Furthermore, this study also comes to a common suggestion as many studies did that government should increase budget allocation on health sector especially for those whose per capita health expenditure is still in low level. Though this recommendation has been frequently suggested, however the repetitions will remain governments to continuously pay more attentions on health issues. Moreover, due to the budget constraint, governments can focus on widening access of health services both to low income group and people in rural and remote areas. Because of lack health services, people in these areas sometimes are forced to sell land and other productive assets to get adequate health services in city even though it is a costly alternative. Losing land and other productive assets will impoverish them in the future. Therefore, an increase in health expenditure for widening access of health services at affordable price is not only able to improve the quality of human being but also protect the people from the poverty trap.

V. CONCLUSION

The rapid social and economic development shown by increasing number of female secondary school enrollment ratio and increasing ratio of urban population has significantly reduced the fertility rate in Southeast and South Asian Countries. Moreover, the under-five mortality rate is an important factor influencing high fertility rate in this area. A higher mortality rate implies a higher risk for losing children before they grow up. Consequently, the parents, as a rational agent, will produce more children to cover their risk. Surprisingly, the fertility rate (demand for children) follows the demand for normal goods, which are increasing in income and decreasing in price.

Lowering fertility rate through increased access to quality reproductive health services remain the best feasible policy option for developing countries that have limited resources to provide essential public goods and to promote employment opportunities. The best strategy to decrease fertility rate is by reducing infant mortality rate. It can be achieved through widening access to health services and promoting midwife vocational schools and nursing vocational schools to increase the number of health professionals. These policies not only can reduce both infant and mother

mortality rate but also can improve the quality of human being. In the long run, it will help to accomplish the Millennium Development Goals (MDG).

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