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MASTER THESIS
POPULATION STUDIES

Population Research Center
Faculty of Spatial Sciences

ADVISABLE AGE AT FIRST MARRIAGE AND BIRTH INTERVAL TO ACHIEVE A LOWER TFR:
a case study of Indonesia

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SUMMARY

In order to minimize possible economic and social problems in the future, Indonesia need to lower the fertility to TFR of 2.1 per women.

This research tried to seek variables that could be used to control TFR. It is expected that by managing socioeconomic variables, the age at first marriage rises and the birth interval could be shortened, therefore TFR of 2.1 could be achieved.

Data from Indonesia Demographic Health Survey (IDHS) 2007 is used. Based on Partial Least Square (PLS) regression result, this research suggest that to achieve TFR of 2.1, the age at first marriage should be increased from national current age at first marriage of 19.8 years old to 23.7 years old, whereas the birth interval is preferably to be increased from current national birth interval of 54.6 months to 60 months.

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"I will lift up mine eyes unto the hills, from whence cometh my help. My help cometh from the LORD, which made heaven and earth"
(Psalm 121:1-2)

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ABSTRACT

In 2015, due to TFR stagnancy at 2.6 per woman, Indonesia will face total population of 255 million people compared to 237 million people predicted before. The deviation on total population rises up concerns on possible economic and social problems in the future. Therefore, there is a need to lower the fertility into Net Replacement Rate or TFR of 2.1 per women.

To answer this problem, this research tried to seek variables that could be used to control TFR. Based on Davis and Blake concepts of proximate determinants of fertility and Bongaarts and Potter analysis on proximate determinants, this research analyze the possibility to utilize socioeconomic variables to lower the TFR. The socioeconomic variables are wealth index, level of education, urban-rural residence, child mortality, contraceptive knowledge, and working status. It is expected that by managing socioeconomic variables, the age at first marriage rises and the birth interval could be shortened, therefore TFR of 2.1 could be achieved.

Data from Indonesia Demographic Health Survey (IDHS) 2007 is used. Based on Partial Least Square (PLS) regression result, this research suggest that to achieve TFR of 2.1, the age at first marriage should be increased from national current age at first marriage of 19.8 years old to 23.7 years old, whereas the birth interval is preferably to be increased from current national birth interval of 54.6 months to 60 months. To ensure fulfilment of the age at first marriage and birth interval, four variable of socioeconomic could be utilized. These are effort to increase contraceptive knowledge, reduce child mortality, open more opportunity for women to work, and encourage women to attain higher education.

Keywords: TFR, age at first marriage, birth interval, socioeconomic, Indonesia, IDHS, Partial Least Square

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CHAPTER 1
INTRODUCTION

1.1. Background

According to Preston (1996), concerns on the pace of world's population growth has been brought into discussion since 1940s. This concern was evolve from concern on exhaustible resources in 1940s, physical capital in 1950s, human capital in 1980s, and the returns of Malthusian origin later on in 1990s.

The Malthusian believes that the uncontrolled population growth will out paced earth's capacity to support human life. An article written by Brown et al (1999) highlighted concerns on remarkable population growth. Brown et al reports doubling on world's population from 2.5 billion in 1950 to 5.9 billion in 1998. They point out the impacts of the population growth to the human prospects on food and agriculture, environmental resources, economics and quality of life.

Brown's et al concern was retrospective to Suharto's idea, Indonesia's former president in New Order era back to the end of 1960s. Suharto's views of seeking improvement in economic development underlines the needs to control population growth. This movement ensure minimum negative consequences of population growth to the development of economic (Niehof and Lubis, 2003a). To ensure manageable population growth, Suharto declared Presidential Decree no. 8 in 1970, regarding establishment of National Family Planning Coordinating Board (NFPCB). The mission of NFPCB is to create small prosperous pleased family. Within this mission, NFPCB focuses its effort to maintain acceptable fertility rate, while lowering both infant and maternal mortality (BKKBN 2009a, 2009b).

Indicator of fertility of a population usually measured as Total Fertility Rate (TFR). TFR is the average number of children a woman would bear if she survived through the end of the reproductive life span and experienced at each age a particular set of age specific fertility rates (Preston, 2001).

Through three decades of family planning, NFPCB has been able to lower the national Total Fertility Rate (TFR) from 5.1 in 1975 to 2.6 in 2002/2003 (Boayes 1995, IDHS 2004). Although this figure is pleasing, NFPCB is facing stagnation to lower the national TFR. The result of the latest Indonesia Demographic and Health Survey (IDHS) 2007 reports TFR remains at 2.6 (IDHS, 2008). Therefore, the tendency of TFR converging at 2.6 per women is very convincing. This rate still high compared to TRF of 2.1, which Indonesia Central Bureau of Statistics (ICBS) considered equal to Net Replacement Rate (NRR) of one. By means of TFR 2.6, in 2015, Indonesia will facing total population of 255 million people compared to 237 million people assumed before (Kompas 2008a, 2008b, 2008c; ICBS, 2005).

Deviation of 18 million people considered as enormous. This deviation rises up concerns on potential economic and social problems in the future as consequences of outpaced economic development. Moreover, Asia economic crisis in 1998 and unstable political situation after Suharto regime fell also gave pressure on the urge of an efficient and the effective family planning program to answer this threat (Niehof and Lubis, 2003b).

As a part of its continuous programs, NFPCB promotes '4T Preventing Program' to attract awareness of the society to support family planning. It emphasizes four 'too' preventions, which are prevention of giving birth 'too' young, prevention to have 'too' many children, prevention to 'too' constricted birth interval, and prevention to give birth in 'too' old age (Kompas, 2008d). The goal of the program is to afford quality of life both for infant and maternal while also lowering TFR. This program conducted to encourage self-awareness on infant and maternal issues. NFPCB hopes the program will be widely accepted and gathered numbers of new participants.

Related to the effort in lowering TFR, the '4T Preventing Program' mentions the higher age at first birth and idea of birth interval. While managing people choice of age at first birth is harder than managing people choice of age at first marriage, it is more common to advise age at first marriage rather than to advise age at first birth. It has been confirmed by Tiwari et al (2005) that age at marriage and age at first birth is significantly correlated (0.4608).

The idea of birth interval is analogous to Bongaarts (1993) model of natural reproduction. In brief, Bongaarts stated that longer birth interval will shorten reproductive life span. As the

consequences, TFR will be lower.

Previously, Agarwala (1960) research report of India stated if India could pushed average age of women at marriage further up to 20, the birth rate would very likely decline by 30%. Agarwala statement is similar to Smith. Smith (1983) found that aggregate patterns almost invariably show that later marriage means lower overall fertility (Hirschman, 1994).

Researcher pointed that both birth interval and age at first marriage affected by social economic status. Omer (1994) reports that birth interval affected by socioeconomic status resembling education, work status, and place of residence. Regarding place of residence, Kabir and Sufian (2009) reports, in case of Bangladesh, women in rural area have longer birth interval duration compared to their urban counterpart. Audinarayana and Senthilnayaki (1990) reports that age at first marriage affected also by social economic status. Audinarayana and Senthilnayaki's research mention educational status, occupational status, and economic status of the respondent and husbands and their fathers exerted a significant positive influence on the age at first marriage.

These facts depict that there is socioeconomic the effect to fertility through age at first marriage and birth interval as intervening variables. Therefore, by managing socioeconomic variables, it is likely possible to model a proper age at first marriage and birth interval. Related to NFPCB family planning program, the model could be used to analyze which socioeconomic factor can be utilized to answer TFR stagnation.

1.2. Research Objective

The objective of this research is to develop a quantitative TFR model which includes age at first marriage and birth interval as intervening variables. Socioeconomic factor also included in the model as set of variables which affect the age at first marriage and birth interval. The model would be used to calculate advisable age at first marriage and birth interval in order to achieve TFR of 2.1 through socioeconomic factor utilization.

1.3. Research Questions

To fulfill the research objective, this research will answer the main question: How is the appropriate model age at first marriage and birth interval to achieve lower TFR by utilizing socioeconomic?

In addition, questions bellow will be answered to sharpen the fulfillment of the research objective:

1. What is the current TFR, age at first marriage, birth interval, and socioeconomic in Indonesia?
2. How is the effect of socioeconomic to age at first marriage and birth interval?
3. How is the effect of age at first marriage and birth interval to TFR?
4. What is the advisable age at first marriage and birth interval to achieve TFR of 2.1?

1.4. Structure of the Thesis

To answer these research questions, Chapter 1, Introduction, would be followed by explanation on conceptual and theoretical framework. Chapter 2, Conceptual and Theoretical Framework, will review theories, which will be use as the base for TFR model. Chapter 2 will be summed up with a figure of conceptual model for TFR.

Chapter 3, Data and Methods, will start with an overview of available data. As the base data, the latest data set from Indonesia Demographic and Health Survey (IDHS) 2007 will be discussed followed by conceptualization and operational of variables as depicted in conceptual model. A section on data analysis method will also present to give a notion on how the TFR model would be built.

Chapter 4, Result, will present Indonesia general characteristic, TFR, variables related to age at first marriage, birth interval, and socioeconomic. A TFR full model, which includes all variables discussed in chapter 3, will be calculated. A TFR simplified model, which includes only significant causal relationship between variables, will be also calculated. Based on TFR simplified model, several scenarios to lower TFR will be computed followed by discussion on these scenarios. Feasibility of each scenario will be reviewed in order to advice a proper age at first marriage and birth interval.

Chapter 5, Conclusion and Recommendation, concludes this research. In this chapter, a brief answer to research questions will be provided. Recommendations to the policy maker also will be given followed by input for upcoming study.

CHAPTER 2
CONCEPTUAL AND THEORETICAL FRAMEWORK

2.1. Theory of Fertility

2.1.1. Maximum Fertility

According to Bongaarts and Potter (1983), reproduction could start in the mid-teens and can continue until age 50. They mention the possibility of birth intervals lasting 1 year or less due to a full-term gestation which only takes 9 months. Assuming the absence of all biological and behavioral constraints on reproduction, it is reasonable to affirm one year average birth interval. Based on this assumption, a woman could have a biological maximum of 35 births (not counting multiple births) between age 15 and 50.

Although theoretically 35 births per woman are feasible, the actual maximum fertility is far less of this biological maximum. Reliable reports on the highest observed marital fertility rates lead into the Hutterite communities. The Hutterites are members of an Anabaptist sect descendent from Swiss settlers in the northern United States and in Canada. They live in small communities in which strict social and religious control exists over most aspects of daily life. In 1950, women who had reached the end of the childbearing years had born an average of about nine children (Eaton and Mayer, 1953).

Bongaarts and Potter (1983) mention that the Hutterites high fertility was made possible by marriage at early twenties and birth interval of 2 years throughout their reproductive years. Less prolonged breastfeeding periods among the Hutterites were taking a part in reducing their birth interval. This short breastfeeding period made their period of postpartum infecundability was about 6 months only.

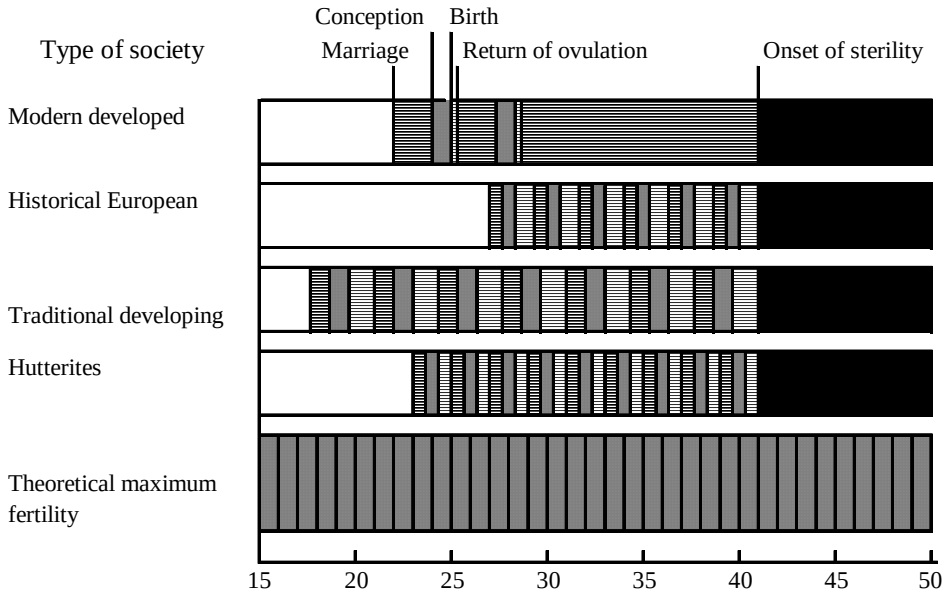
Bongaarts and Potter (1983) also describe others selected population reproductive patterns. These populations are traditional developing society, historical European population, and modern developed society.

In brief Bongaarts and Potter explain that traditional developing society, in this case are the least developed nations in Africa, Asia and Latin America could have seven births per women. This was due to the practices of early marriage and birth interval around 3 years. The birth interval was possible to be longer compared to historical European population due to prolonged breastfeeding.

Historical European population which takes place in seventeenth and eighteenth century was indicated by marriage in the mid-twenties and birth interval around 2.5 years. These factors made historical European population could have about six births per women.

In modern developed society which Bongaarts and Potter mention as contemporary Western populations, women bear on average around two births during their reproductive period. Although women in modern developed society marriage in the early twenties but due to the efficient contraceptive use or the practice of induced abortion, they could avoid having further birth before the onset of sterility. Moreover Bongaarts and Potter mention that in modern developed society, the postpartum infecundability is rather short, therefore birth interval is much more affected by contraception which prolongs the conception wait. Figure 2.1 summarize Bongaarts and Potter description on theoretical maximum fertility, the Hutterites, traditional developing, historical European, and modern developed society reproductive patterns.

Figure 2.1 Average Timing of Reproductive Events in Selected Types of Societies



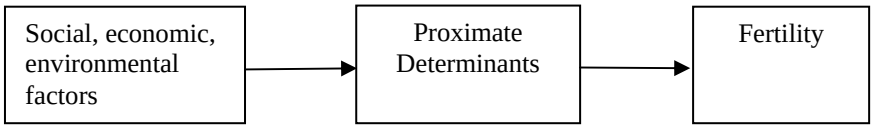
Source: Bongaarts and Potter (1983)

Throughout decades, researcher in field of biology and social science aim to explain low actual fertility compared to the possible maximum fertility. While reproductive physiologist have made an extensive studies of the process of ovulation, spermatogenesis, fertilization, and their regulation with contraceptive technology; social scientist believe that the number of children born to a woman is likely affected by social norms, economic consideration, and cultural factors. It was the French demographer Louis Henry and the American sociologist Kingsley Davis and Judith Blake who introduce the mechanisms through which socioeconomic processes and human behavior interact with the biological aspects of human reproduction (Bongaarts and Potter, 1983).

2.1.2. Proximate Determinants of Fertility

Davis and Blake (1956) introduce the concept of proximate determinants of fertility to enlighten the cause of fertility variation. Proximate determinants of fertility could be defined as the biological and behavioral factors in which fertility is directly influenced. Fertility differences among populations are perceived as the effect of variation in one or more proximate determinants components. Afterwards, the proximate determinants are positioned as a bridge in relating social, economic, and environmental variables outcome to fertility variation.

Figure 2.2 Relationships among the Determinants of Fertility



Source: Bongaarts and Potter (1983)

In their studies, Davis and Blake (1956) identified a set of 11 proximate determinants in three different variables groups. These groups are intercourse variables, conception variables, and gestation variables.

These set of proximate determinant of fertility were refined by other researcher to be easily incorporated into quantitative fertility studies. Bongaarts and Potter (1983) state that model builders mostly based their work on Henry's analysis of the reproductive process. Through this approach, a closely overlapping set of proximate determinants are produced. This set of proximate determinants has greatly simplified the task of constructing fertility model.

The proximate determinants of fertility based on Henry's studies are rooted to the duration of the reproductive period and the rate of childbearing during the reproductive period. Bongaarts and

Potter (1983) explain that women's potential reproductive period could be started at menarche. Since societies limiting childbearing only to women in relatively stable unions, menarche is not necessary positioned as women's reproductive period until stable unions are formed. This reproductive period will last until the onset of permanent sterility or menopause, unless a marital disruption occurs. Fecund women in marital are reproduce at rate which is related to birth interval. In this case short birth interval will produce high fertility and vice versa.

Bongaarts and Potter (1983) stated that the length of birth interval might different incase of intrauterine mortality. In the absence of intrauterine mortality, the length of a birth interval is determined by postpartum infecundability interval, the waiting time to conception, and full term pregnancy. While in the occurrence of spontaneous or induced intrauterine mortality, the length of a birth interval is determined by a shortened pregnancy, a brief infecundability, and a conception delay.

In brief, there are seven proximate determinants which is marriage (and marital disruption), onset of permanent sterility, postpartum infecundability, natural fecundability or frequency of intercourse, use and the effectiveness of contraception, spontaneous intrauterine mortality, and induced abortion (Bongaarts and Potter, 1983).

There are certain mechanisms on which proximate determinants interrelated to reproductive period and birth interval. While marriage (and marital disruption) and onset of permanent sterility determine the duration of the reproductive period, the other five determinants determines the rate of childbearing and the duration of birth interval. Regarding the postpartum infecundability, Bongaarts and Potter (1983) explain that in most societies the duration of postpartum infecundability equals the duration of amenorrhea (or ovulation). Moreover, they add that breastfeeding is the principal determinant of amenorrhea.

2.1.3. Natural Fertility

Henry (1961) defines natural fertility as fertility in the absence of deliberate birth control. Later on, he refines his definition on natural fertility to be more practical. He mentions that fertility may be considered natural if no contraception or induced abortion is used (Henry, 1979).

Although with the absence of contraception or induced abortion, natural fertility always fell behind the biological maximum. Bongaarts and Potter (1983) mention society's level of natural fertility is constrained by marriage pattern and the society natural marital fertility.

Different society might have different marriage pattern and natural marital fertility, but empirical research done by various researcher lead into a conclusion of age-specific marital fertility is relatively invariant (Coale and Trussel 1974, Henry 1961, Knodel 1977). It means age-specific natural marital rates pattern on different societies likely indifferent. Those researches demonstrate age-specific natural marital rates decline with age. Based on this finding, Coale and Trussel (1974) have proposed a standard schedule of natural marital fertility. By comparing age-specific fertility to the standard schedule of natural fertility has allowed the identification of whether a population is in natural or regulated marital fertility.

Table 2.1 Coale and Trussel's Standard Schedule of Natural Marital Fertility

Age	Relative marital fertility level
20-24	100
25-29	94
30-34	86
35-39	70
40-44	36
45-49	5

Source: Bongaarts and Potter (1983)

Bongaarts and Potter (1983) mention that there are five proximate determinants which can affect natural fertility. These proximate determinants is age at marriage, age at end of childbearing years, duration of postpartum infecundability, conception delay, and time added by intrauterine mortality.

In order to observe the most important determinant of variations in natural fertility, Bongaarts and Potter (1983) tabulate approximate observed ranges and standard values of population averages of proximate determinants of natural fertility.

Table 2.2 Bongaarts and Potter's Approximate Observed Ranges and Standard Values of Population Averages of Proximate Determinants of Natural Fertility

Proximate determinants	Approximate range of averages (years)	Model standard (years)
Age at marriage	15.00 – 27.5	22.5
Age at end of childbearing years	38.5 – 41.0	40.0
Duration of postpartum infecundability	0.25 – 2.0	1.0
Conception delay	0.4 – 0.85	0.6
Time added by intrauterine mortality	0.1 – 0.2	0.15

Source: Bongaarts and Potter (1983)

By applying sensitivity analysis, Bongaarts and Potter (1983) conclude that variation in age at marriage and the duration of postpartum infecundability are, in general, the most important determinant of variations in natural fertility. They estimate standard total fertility rate of 7. However if fertility inhibiting the effects of delayed marriage, marital disruption, and breastfeeding are removed, Bongaarts (1978) estimated that the natural fertility can reach around 15 births per woman

2.1.4. Regulated Fertility

Level and trends on total fertility rate from data presented in United Nation (1980) point out that total fertility rates in all continents were less then the standard total fertility rate. Although the data is already old but even the data from later year never confirm a continent with total fertility rates equal to standard total fertility rate. It indicates that there are certain factors that might cause total fertility rate bellow the levels implied by the natural marital fertility rate.

Table 2.3 World's Total Fertility Rate 1955-1975

Region	Total Fertility Rate			Decline
	1955	1965	1975	1955-1975
Africa	6.5	6.5	6.4	-0.1
Asia	5.8	5.4	4.6	-1.2
Latin America	5.7	5.5	5.0	-0.9
North America	2.8	2.4	1.8	-1.0
Europe; USSR	2.7	2.5	2.2	-0.5

Source: United Nation (1980)

A population could control its fertility level by limiting number of years of exposure to childbearing, use of contraception, and induced abortion. While limiting number of years of exposure to childbearing is related to natural fertility, use of contraception and induced abortion are the main characteristic of regulated fertility (Bongaarts and Potter, 1983).

Bongaarts and Potter (1983) summarize level and trends of eight countries contraceptive-use during 1965 to 1975. By comparing fertility and contraceptive-use level, they found a high correlation between these two variables. This correlation is not perfect as fertility also affected by the effectiveness of contraceptive use and by other proximate determinants.

A study on the effectiveness of contraceptive in United States conducted by Vaugan, Trussel, Menken, and Jones (1977) reveal cumulative 1-year use-failure rates ranged from 0.02 for the pill to 0.191 for the users of the rhythm method.

Table 2.4 Observed U.S. Cumulative 1-Year Use-Failure Rates and Estimates of Corresponding Contraceptive Use-the effectiveness Level

Contraceptive Methods	Cumulative 1-year use-failure rate	Approximate use-the effectiveness
Sterilization	(0.0)	(1.00)
Pills	0.020	0.99
IUDs	0.042	0.97
Condom	0.101	0.94
Diaphragm	0.131	0.92
Foam/Cream/Jelly	0.145	0.91
Rhythm	0.191	0.87
Other	0.108	0.93

Source: Vaughan, Trussell, Menken and Jones 1977, Bongaarts and Potter 1983

There was no availability on use-failure rates from other developed country. For developing country, a study in Philippines by Laing (1978) provides the following method-specific use-failure rates: pills: 0.05; IUDs: 0.04; rhythm: 0.20; and condom: 0.38.

Beside the use of contraception, induced abortion also contribute to lower fertility level in regulated fertility. Tietze (1981) reviews in his study that access to legal abortion in different countries is vary. This is related to the extent of restrictions imposed by law. According to Tietze (1981), the world's proportion on imposed law of legal abortion to be as follows: 28% abortion prohibited without exception, or allowed only to save the life of the woman (e.g., majority of countries in Latin America and Africa, and Muslim countries of Asia), 10% abortion authorized on broader medical grounds to avert threat to woman's health (often including mental health) and on eugenic or juridical (rape, incest) indication (e.g., Korea), 24% termination of pregnancy allowed on social-medical grounds such as health, unmarried status, or inadequate income (e.g., most of Eastern Europe, Japan, India), 38% abortion on request, but generally limited to the first trimester of pregnancy (e.g., U.S., USSR, China, France).

2.1.5. Determinants of Proximate Determinants

In their attempt to understand the cause of fertility variation, Davis and Blake (1956) recognize the mechanism through which the socioeconomic variables influence fertility. This mechanism could be presented as in figure 2.2. In this mechanism, the social, economic, and environmental factor are related to fertility in which the proximate determinants proceed as intervening variables.

Bongaarts and Potter (1983) view the socioeconomic factors, health, and nutrition as the determinants of proximate variables. They concludes that socioeconomic factors have an important role in fertility trends and differential, while health and nutrition, in general, relatively unimportant. They also mention that there is no general conception on how socioeconomic and cultural factors affecting the proximate determinant and fertility.

2.2 Economic Theory of Fertility

Efforts to understand economic and fertility relationship were found far early before Davis and Blake propose proximate determinants as intervening variable between social, economic, and environmental to fertility. Andorka (1978) dated back the attempt to understand economic and fertility relationship into Alfred Marshall. Alfred Marshall's 'Principles of Economics' describes relations between short-term economic fluctuation and demographic phenomenon. In one of his observation, he viewed the rise in the price of wheat in early nineteenth century in England diminished the number of marriages in the working class.

Later on, a formulation so-called economic theory of fertility was created. This formulation is likely to be inspired by Marshall's observation. According to Andorka (1978), the fundamental basis of economic theory of fertility is:

1. Couples behave in a rational way when they decide on the number of children they want to have.
2. Children are viewed by the couples more or less as consumption goods.

This economic theory of fertility is parallel to Hicks-Allen consumption theory. In their theories, Hicks-Allen stated that the choices of goods or consumption decisions of individuals or families are determined by their relative preferences for the different goods available, the price of these goods and their income. In this case, economic theory of fertility views children as consumption goods in which the couple choice of the number of children is affected by all other goods and services they want.

This reasoning, however should lead a higher income level into higher number of children, but in many case, it is the opposite. In order to explain this, Becker (1960) provided a simplest explanation. He introduce the idea of higher income gain a higher level of information on methods of birth control and spent more their money to improve the quality of children. That is the reason why a higher income would usually choose a lower number compared to a lower income.

Another opinion comes from Okun (1958) who reject the explanation of the number of children in terms of simple consumption theory. He believes that there is a fundamental distinction between children and commodities. Okun stated that the minimum cost per children is lower for low income and low status families, which leads into higher number of children.

Leibenstein (1957, 1974) who formulate new economic theory of fertility introduce the idea of reasoning on utility and disutility for which the children bring is affecting fertility. The increase of per capita income, the decline in mortality, and changes in occupational structure integrated in socioeconomic development are influencing this utility and disutility.

Mincer (1963) mentions the lost of potential family income of the wife who bears and cares for children might affecting couples decision on fertility. In the society in which the densities of women who have low education are high, the impact of potential family income lost toward fertility is likely lower compared to the society in which the densities of woman who have low education are low. In this case, society with high density of low educated woman is expected to have a higher number of children born compared to the society with low density of low educated woman.

In his attempt to formulating Becker theory, Simon (1969) includes four economic and social factors of fertility. His work are done to explaining the fact that desired fertility in many cases does not show the positive relation to income which postulated by Becker. The four economic and social factors of fertility proposed by Simon are: (1) income (2) cost of child-raising, (3) investment value of children, (4) a complex factor of modernization. He mentions education, urban-rural residence, child mortality, and contraceptive knowledge as components of modernization.

Blake (1968) has criticized the establishment of economic theory of fertility. Blake mentions that instead of economic considerations, families are influenced in their decisions on fertility by the norms and values of society. In her analysis on the ideal number of children in the United States, she found no the effective sign of positive relation between income and fertility. According to Blake, 'fertility is determined by the characteristics of family and the general norms and values attributed to the concept of family in the given society, and the more fundamental changes of fertility are caused by the changes of the institution of family; therefore a theory of reproductive motivation is at the same time a theory of the family and society.'

2.3 Integrated Model of Fertility

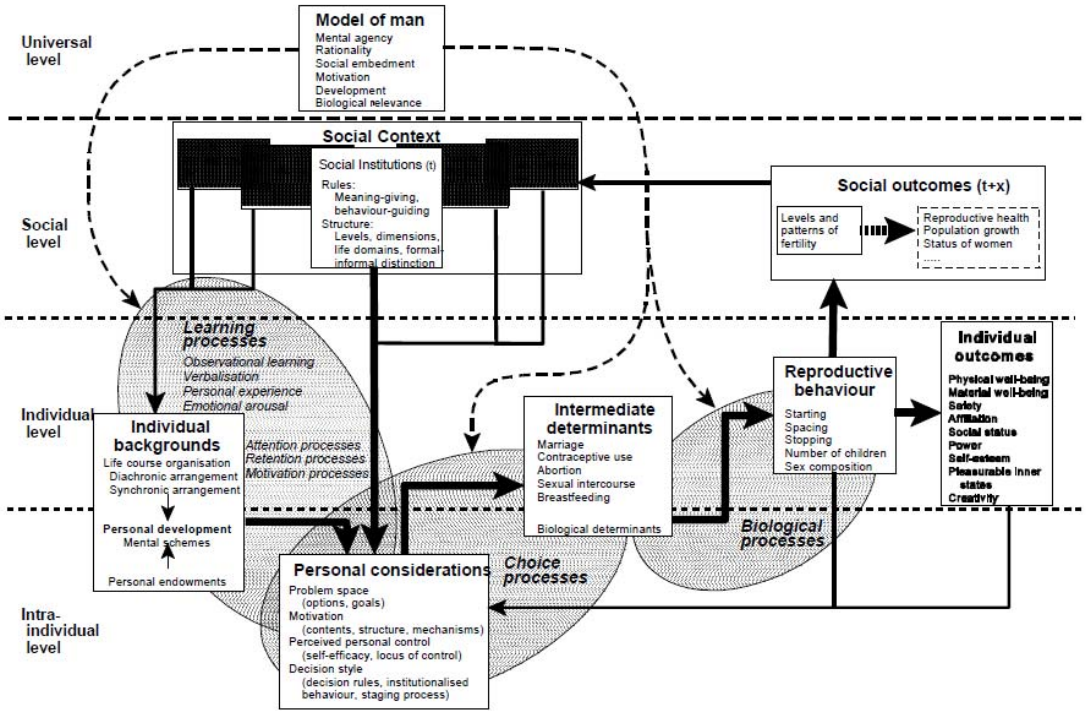
Economic theory of fertility has leads into the idea that fertility behaviour of a population shaped by socioeconomic factors. Fertility is the result of learning process that is includes rational choice of couple based on the values of children. Various factors are affecting the values of children. Simon (1969) mention four economic and social factors of fertility, which are income, cost of child-raising, investment value of children, and a complex factor of modernization. These four economic and social factors determine the fertility of a population. Later on, Blake (1968) adds that norms and values of the society also be a factor in family decision on fertility.

This relationship pattern on factors influencing fertility is also found in more comprehensive 'integrated model of fertility' by Bruijn (1999). Rather than concentrating in level and patterns of fertility and social, cultural, economic and political backgrounds situated at a macro-analytical level, Bruijn incorporates idea that the social environment must be expressed in terms that bear relevance to the individual agents.

Bruijn (1999) derives a multilevel approach in his integrated model of fertility. By extending the process-context approach, he divide fertility phenomenon into universal level, social level, individual level, and intra-individual level.

The integrated model of fertility describe interrelationship between at least seven components. These include the model of man for demography, the social context, the principle of learning, the individual backgrounds of personal endowments and life course development, the concept of choice, reproductive behavior and its intermediate determinants (similar to Bongaarts and Potter's proximate determinants), and social and individual outcomes of decision making. Based on Coleman's foundation of social theory (Coleman, 1990), Bruijn defined major theoretical task to provide a comprehensive explanation of fertility phenomena. To assess the context of individual behavior, he describes how social context shapes individual backgrounds through learning process. Bruijn explains individual action, in this case is reproductive behavior, influenced by model of man for demography and social context through set of learning, choice, and biological process in individual and intra-individual level.

Figure 2.3 Bruijn's Integrated Model of Fertility



Source: Bruijn (1999)

In his representation of reproductive behavior and intermediate determinants of fertility, Bruijn based his model on the analytical framework of intermediate fertility variables of Davis and Blake (1956), and on Bongaarts' model of proximate determinants (Bongaarts 1978, Bongaarts and Potter, 1983). He translates this framework into individual level.

On intermediate determinants, he explains that 'people cannot directly determine the desired reproductive outcome. They can only influence fertility by managing one or more of the intermediating determinants' (Bruijn, 1999). In this case, the intermediate determinants are important component in the model to explain other components causal relation to reproductive outcomes.

2.4 Previous Research Related to Fertility and Socioeconomic

Although Bruijn's integrated model of fertility sum up most contemporary knowledge on fertility behavior, but previous study integrating Davis and Blake's relationships among the determinants of fertility and Bongaarts and Potter's Seven proximate determinants which was analyzed using empirical data were rare.

However, research that partially uses Davis and Blake's relationships among the determinants of fertility were many. Some of these researches analyze the effect of socioeconomic to age at first marriage or birth interval only (Omer 1994, Kabir and Sufian 2009, Audinarayana and Senthilnayaki 1990), and some other analyze the effect of age at first marriage to lower the fertility outcomes (Agarwala 1960; Smith 1983 cited in Hirschman 1994). Bongaarts's (1993) model of natural reproduction also gives a foundation that the longer birth interval will shorten reproductive life span and for this reason, TFR will be lower.

2.5 Conceptual Framework

While relationship of proximate determinants and fertility on figure 2.2 is well-built and generally accepted by researcher, the mechanism to explain of existence difference in fertility is still expanding.

Bongaarts and Potter (1983) comprehensive explanation on proximate determinants lead into seven proximate determinants. These proximate determinants operate in two groups which are reproductive period and birth interval.

In most societies, due to social sanction, age at first marriage is considered as the start of women reproductive carrier rather than age at menarche. Bongaarts and Potter (1983) description on modern developed society explicitly mention that end of reproductive carrier could be attained before onset of sterility due to efficient contraceptive or induced abortion practice. Therefore the end of women reproductive carrier is not necessary occur as onset of sterility but at the age when women decide to avoid further birth by practicing efficient contraceptive or induced abortion. In this research the age when women decide to avoid further birth will be named as age at end of childbearing. Based on these theoretical thinking, the reproductive period is determined by age at first marriage and age at end of childbearing.

Bongaarts and Potter (1983) explain that birth interval is determined by postpartum infecundability, natural fecundability or frequency of intercourse, use and the effectiveness of contraception, spontaneous intrauterine mortality, and induced abortion. They explain that postpartum amenorrhea could be utilized instead of postpartum infecundability since in most society, the duration of both are equal. They also mention that breastfeeding the effecting postpartum amenorrhea.

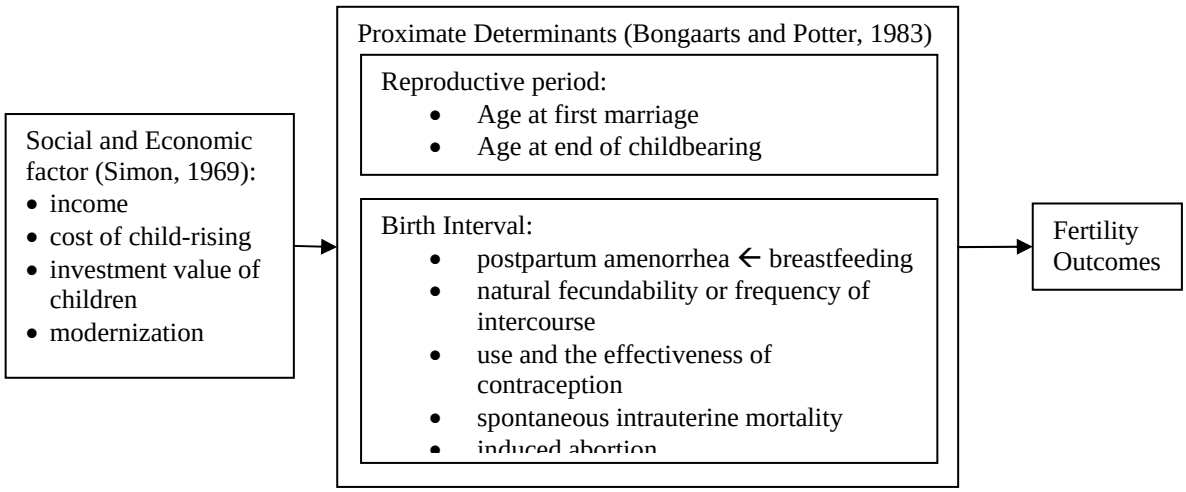
From economic theory of fertility, an insight of how economic and social variable determines fertility could be found. In general, Simon (1969) sums four factors of economic and social variable, which affect fertility: (1) income, (2) cost of child-raising, (3) investment value of children, (4) a complex factor of modernization.

Blake (1968) arguments on families fertility decision is affected by the norms and values of society had emphasize that there is a rational thinking process related to social context when couples decide on the number of children they want to have.

Incorporating previous ideas in fertility, Bruijn's integrated model of fertility gives a solid fundamental theoretical framework on how fertility situated in process-context approach. His model is much extended intercorrelates model of man for demography, the social context, the principle of learning, the individual backgrounds of personal endowments and life course development, the concept of choice, reproductive behavior and its intermediate determinants, and social and individual outcomes of decision making.

This research conceptual model, as displayed in figure 2.4, is based on Davis and Blake's (1956) description on relationships among the determinants of fertility as mentioned in Bongaarts and Potter (1983). Since the objective of this research emphasize socioeconomic factor, therefore our conceptual model only incorporate socioeconomic rather than full factor of social, economic, and environmental factor. Compared to Bruijn's approach to comprehensively framing fertility in multilevel approach, we simplify our conceptual model in macro-level. We views Simon's four social and economic factors similar to Bruijn's social context.

Figure 2.4 Conceptual Model



CHAPTER 3
DATA AND METHODS

3.1. Research Design

The purpose of this research is to explain TFR through age at first marriage and birth interval as endogenous factor; and socioeconomic as exogenous factor. Therefore this research could be categorized as explanatory research. In this research, we expect an output of quantitative TFR model in which prediction of TFR could be made.

TFR is synthetic variable which is means that TFR cannot be attained in individual level; consequently analysis should be brought into aggregate level. This research will use province as unit of analysis to accommodate the needs of analysis in aggregate level.

There is an advantage of using province as unit of analysis. The advantage is calculation on TFR model could be applied on conducting specific population policy regarding fertility for each province.

Since socioeconomic are changing through times, prediction on TFR based on previous socioeconomic might lead into less accurate prediction. In order to accurately predict TFR, capturing the latest socioeconomic phenomenon is important. For that reason, this research will use a cross sectional study design.

This research will use secondary data from the latest provincial table of Indonesia Demographic Health Survey (IDHS) 2007. The decision to use IDHS data is based on the accessibility of IDHS data, abundant information on fertility which is available in IDHS data, and international recognition of Demographic Health Survey. By using secondary data, this research evades excessive time and cost in questionnaire construction, sample selection, and data collection process.

3.2. Indonesia Demographic Health Survey

To acquire a better understanding on IDHS, its research design, and which data available through IDHS, this section will discuss briefly IDHS history, the research design of IDHS 2007, and data which could be obtained through IDHS 2007.

IDHS is the main demographic data sources for Indonesia health survey and family planning. Considering its time dimension, IDHS is cross-sectional studies, which provide information on levels and trends of fertility, infant and child mortality, family planning, and maternal and child health at a given time (IDHS, 2008).

There are six series of IDHS data in 3 to 5 years survey interval. These data were dated from 1987, 1991, 1994, 1997, 2002/2003, and 2007. The data are gathered though questionnaire. Three questionnaires were used in IDHS 2007. These questionnaires are: the Household Questionnaire, the Ever-Married Women's Questionnaire and the Married Men's Questionnaire (IDHS, 2008).

The main purpose of Household Questionnaire was to identify women and men who were eligible for the individual interview. The Household Questionnaire also provides household's socioeconomic measurement based on characteristics of the household's dwelling unit (IDHS, 2008).

The Ever-Married Women's Questionnaire was used to collect data on: (1) the background characteristics (marital status, education, media exposure, etc.), (2) knowledge and use of family planning methods, (3) reproductive history and fertility preference, (4) antenatal, delivery and postnatal care, (5) breastfeeding and infant feeding practices, (6) vaccinations and childhood illnesses, (7) practices related to the malaria prevention, (8) marriage and sexual activity, (9) woman's work and husband's background characteristics, (10) infant's and children's feeding practices, (11) childhood mortality, (12) awareness and behavior regarding AIDS and other sexually transmitted infections (STIs), and (13) sibling mortality, including maternal mortality. The Ever-Married Women's Questionnaire was administered for all ever-marriage women age 15-49 years (IDHS, 2008).

The Married Men's Questionnaire was conducted for all currently married men age 15-54 years for every third household in the IDHS sample. The Married Men's Questionnaire gathered data on men knowledge and participation in health-care-seeking practices for their children (IDHS, 2008).

In IDHS 2007, the population target is every household in Indonesia. Therefore, IDHS sampling unit is households. Stratified probabilistic sampling were use to drawn sample from population. This method is selected to produce estimates at the national, urban, and provincial levels.

Calculation procedure of sampling size is based on Demographic Health Survey (DHS) standard, which is described on DHS Phase III Sampling Manual.

IDHS 2007 data collection period took place from 25 June to 31 December, 2007 apart from several province including Riau Islands, Papua, and West Papua because flooding and other problems. In these provinces, fieldwork was completed in February 2008 (IDHS, 2008).

In that period, 42,341 households were selected in the sample, of which 41,131 were occupied. Of those households, 40,701 or 99 percent were successfully interviewed. In interviewed households, 34,227 women were identified eligible for individual interviews. From this number, there were 32,895 women completed interviews, yielding a response rate of 96 percent. Due to the more frequent and longer absence of men from the household, only 8,758 men were successfully interviewed from 9,716 eligible men were indentified. This yields a response rate of 90 percent (IDHS, 2008).

Although the sampling unit is households, IDHS has a complete raw data set in which open the possibility to use individual person from each household as the unit of analysis. IDHS also produce demographic and health estimates for each province in their IDHS reports. These demographic and health estimates per province was produced by aggregating micro data obtained either from each household, ever-married women, or married men questionnaire. Detail procedure on how IDHS calculate demographic and health estimates is described on Guide to DHS Statistics written by Rutstein and Rojas (2006).

3.3. Conceptualization

There are three concepts in this research. These concepts are fertility, proximate determinants, and socioeconomic. In proximate determinants concept, there are seven proximate determinants which are the effecting reproductive period and birth interval. Concepts might not have clear definition but description on variables which will be measured for each concept might help to understand the concept it self. Not every variable that theoretically associate with the concept will be used in this research due to the availability on data in provincial table IDHS 2007. The following is the description on each concept.

3.3.1. Fertility

Bongaarts and Potter (1983) define fertility as actual reproduction. There are two variables in which fertility could be measured. These variables are Children Ever Born (CEB) and Total Fertility Rate (TFR).

In general, both variables measure the average number of children born to a woman. However there are some differences between Children Ever Born and TFR. Accurate Children Ever Born can only be measure if women already end her reproductive period. Therefore Children Ever Born calculation is cohort base. Since TFR calculation is period base, TFR is more suitable to obtain current fertility state of a population compared to Children Ever Born.

Preston (2001) defines TFR of a population is the average number of children a woman would bear if she survived through the end of the reproductive life span and experienced at each age a particular set of age specific fertility rates.

In this research, we will use TFR to measure fertility. The decision is made due to the purpose of this research and the needs to capture current fertility phenomenon in Indonesia.

3.3.2. Proximate Determinants

Davis and Blake (1956) define proximate determinants of fertility as the biological and behavioral factors in which fertility is directly influenced. Bongaarts and Potter (1983) mention seven proximate determinants. These proximate determinants are marriage (and marital disruption), onset of permanent sterility, postpartum infecundability, natural fecundability or frequency of intercourse, use and the effectiveness of contraception, spontaneous intrauterine mortality, and induced abortion. These proximate determinants are affecting two variables which are reproductive period and birth interval. While marriage (and marital disruption) and onset of permanent sterility determine the duration of the reproductive period, the other five determinants determines birth interval.

Demographic Health Survey assuming Indonesia as marriage population which means no out marriage children born. As a result, in this research, the age at first marriage will be used as the beginning of reproductive carrier.

Taking notes on Bongaarts and Potter description on modern developed society characterize by efficient contraceptive or induced abortion to end reproductive period and reflecting with 57% of currently married women in Indonesia is using any modern contraceptive method (IDHS, 2008), it is very reasonable to classify Indonesia into modern developed society in terms of fertility. Thus in this research, the end of reproductive period is not onset of sterility.

Age at sterilization might be a good indicator for the end of reproductive period, since women who take sterilization will surely end their child bearing period. However, the number of Indonesia's women under age 40 who takes sterilization is very small. IDHS (2008) reports only 3% of the total sample who take sterilization. It is very unlikely to use age at sterilization as end of reproductive period. Alternative indicator for the end of reproductive period is the age when women decide not to have further births. IDHS (2008) reports 50% of the total sample decide not to have further births. For that reason, in terms of sample size, age when women decide not to have further births is adequate. Question might arise if the age when women decide not to have further births (from this point forward will be mentioned as age at end of childbearing) is taken as the end of reproductive period. It might be questioned that age at end of childbearing might not end women actual reproductive period since there are still possibilities that these women would give further birth. However, related to the model, TFR is measured for current state. In this case whether the women who state that they are do not want more children but later have more children are not affecting the current TFR.

Due to the availability of data provided in provincial table IDHS 2007, this research will not include Bongaarts and Potter's (1983) five proximate determinants which are affecting birth interval. Instead of those five proximate determinants, this research will include current use of contraception, postpartum amenorrhea, and breastfeeding.

3.3.3. Socioeconomic

Study in the theoretical framework did not find any consensus on definition of socioeconomic. A simple definition could be drawn from Oxford English Dictionary which defines socioeconomic as an adjective relating to or concerned with the interaction of social and economic factors. By using this rough definition, it is clear that socioeconomic related to social and economic factor. In IDHS 2007, there is no data on income, cost of child-raising, and investment value of children. Consequently, in this research, socioeconomic is represented in two dimensions. These dimensions are wealth and modernization.

Wealth index is used as indicator variable of wealth. Wealth index is a background characteristic as a proxy for long-term standard of living of the household (IDHS, 2008).

In her study, Baschieri (2005) mentions although various authors have provided definition of modernization, there are no standard definition. She describes modernization as rather a multivariate phenomenon, incorporating economic, social and political characteristics. To measure modernization, Baschieri analyse static component of modernization rather than analyse the modernization as transformation process. She mentions education and working status as few aspects of modernization. Her idea is similar with Simon (1969) on his study of 'The effect of income on fertility'. Simon mentions education, urban-rural residence, child mortality, and contraceptive knowledge as component of modernization. In this research, modernization will be viewed as multivariate phenomenon, with level of education, urban-rural residence, child mortality, contraceptive knowledge, and working status as indicator variables.

3.4. Operational

There are 14 variables which are mentioned in the conceptualization. These variables are wealth index, level of education, urban-rural residence, child mortality, contraceptive knowledge, working status, age at first marriage, age at end of childbearing, reproductive period, duration of breastfeeding, postpartum amenorrhea, current use of contraception, birth interval, and TFR. Operational of each variable could be described as follow.

Wealth index is constructed using data on household ownership of consumer goods, dwelling characteristics, source of drinking water, toilet facilities, and other characteristics related to the socioeconomic status of households. These data are factor score weighted through principal component analysis. The results are standardized into standard normal distribution (Gwatkin et al., 2000).

Total score for each household were assigned by applying the principal component function for all household. Individuals were ranked according to the household total score. The sample divided into quintiles from one to five (IDHS, 2007). One is assigned for the household with lowest wealth index, while five is assigned for household with highest wealth index. Therefore, wealth index measured in individual level in ordinal scale of five categories.

In this research, proportion of the fourth and highest wealth index of each province will be summed to estimate the wealth status.

Level of education is ever married women's median years completed education.

Urban-rural residence is the proportion of household member located in urban area. This data is not provided in provincial table IDHS 2007, but could be calculated from IDHS 2007 household member data set.

Child mortality is child mortality rate in which enumerate death at ages 1 to 4 years per 1000 live births within 0 to 10 years preceding the survey.

Contraceptive knowledge is the proportion of women who know at least one contraceptive method whether traditional or modern.

Working status is the proportion of women who currently employed.

Reproductive period is the age at end of childbearing subtracted by age at first marriage. IDHS (2008) defines *age at first marriage* is as the age at which the respondent began living with her first spouse/partner. This research will use median age at first marriage for women age 25 to 49, which is provided in provincial table IDHS 2007. The median age at first marriage is calculated for women age 25 to 49 only to avoid the problem of censoring for young cohorts. The *age at end of childbearing* is the median age of women who decide not to have further birth when she gave her last birth. Both age at first marriage and age at end of childbearing are in years.

Duration of breastfeeding is median breast feeding duration in month.

Postpartum Amenorrhea is median duration of the absence of menstruation after a birth in month.

Current use of contraception is the proportion of women who currently use any contraceptive method.

Birth Interval is the median number of months since preceding birth in five years preceding the survey.

Total Fertility Rate is the sum of the age-specific fertility rates for all women multiplied by five. The age-specific fertility rates are those for the seven five-year age groups from 15–19 to 45–49.

3.5. Data Analysis

In this research, there is several statistical data analysis method that will be used. These statistical data analysis method are descriptive statistics, scatter plot, boxplot, and Partial Least Square regression. The descriptive statistics, mainly percentage and median presented in tables, will be used to present current fertility, proximate determinants, and socioeconomic situation in Indonesia.

This research is an explanatory research; therefore regression method is suitable to analysis causal relationship from one variable to another. However, since the objective of this research is to explain TFR through age at first marriage and birth interval as endogenous factor; and socioeconomic as exogenous factor, this research need regression analysis that could accommodate structural equation. For the reason that there are only 33 provincial data in Indonesia, which is small, a regression model that could accommodate structural equation using small size data should be used. The need to analyze causal relationship from small size data which has structural equation leads into utilization of Partial Least Square regression.

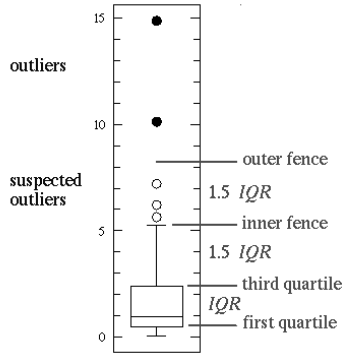
In this research scatter plot, boxplot, and Partial Least Square regression will be used as a series of tools to build TFR model. The result of Partial Least Square regression will be used to answer the effect of socioeconomic to age at first marriage and birth interval, the effect of age at first marriage and birth interval to TFR, and calculating the advisable age at first marriage and birth interval to achieve TFR of 2.1. Bellow is a brief description on each statistical method used

1. *Descriptive Statistics*
   Descriptive statistics are used to present quantitative descriptions of data in a manageable form. These include simple graphics and tables that could be used to show data distribution, central tendency, and dispersion of data. In this research, percentage and median of 14 variables mentioned in conceptualization will be presented in tables to depict the current fertility, proximate determinants, and socioeconomic condition in Indonesia.

2. *Scatter Plot*
   Scatter plot is a graphical tool to depicting diagram of two variables using Cartesian coordinates. In this research, scatter plot will be used as explorative tools to see if there is a relationship between important variables. These variables are age at first marriage, birth interval, and TFR.

3. *Boxplot*
   Boxplot or box-and-whisker plot is a graphical tool to present distribution characteristic of data. Boxplot is useful to see tendency of outlier. An outlier is either 3 x Inter-Quartile-Range (IQR) or more above the third quartile or 3x Inter-Quartile-Range (IQR) or more bellow the first quartile. While an observation suspected as outlier if it is either 1.5 x Inter-Quartile-Range (IQR) or more above the third quartile or 1.5x Inter-Quartile-Range (IQR) or more bellow the first quartile.
   Representation of boxplot application to detect outlier could be seen in figure 3.1.

   Figure 3.1 Boxplot Application to Detect Outlier



   Source: Anonymous (2009)

   In this research, boxplot will be used to see if there is outlier that might affect the result of Partial Least Squares regression. In case of extreme outlier, the outlier should be considered to be taken out before the Partial Least Square regression conducted.

4. *Partial Least Squares (PLS) Regression*
   Partial least squares regression is an extension of the multiple linear regression. PLS regression extends multiple linear regression without imposing the restrictions employed by discriminant analysis, principal components regression, and canonical correlation. In PLS regression, prediction functions are represented by factors extracted from the variance matrix. Therefore, the number of such prediction function that can be extracted typically will exceed the maximum of the number of Y and X variables (Statsoft, 2009).
   Some advantage of using PLS compared to other regression methods are. PLS factors are

orthogonal, therefore PLS is robust to multicollinearity. PLS is a distribution-free approach to regression analysis and path model. As the distribution of PLS is unknown, conventional significance testing is impossible. To overcome this shortage, bootstrap method will be used to produce statistical significance. Despite its advantage, some caution should be concerned such as outliers and nonlinear data relationship (Garson, 2009).

In this research, PLS regression will be used to analyze TFR structural model at province level. These structures could be written as following equations:

Age at Fi… = f(Wealth In…, Education, Residence, Contrace…, Child Mo…, Working …)
Age at E… = f(Wealth In…, Education, Residence, Contrace…, Child Mo…, Working …, Current…)
Breast F… = f(Wealth In…, Education, Residence, Contrace…, Child Mo…, Working …)
Current … = f(Wealth In…, Education, Residence, Contrace…, Child Mo…, Working …)
Postpart… = f(Breast F…)
BirthInte… = f(Current …, Postpart…)
TFR = f(Reprodu…, BirthInte…)

Whereas:

Age at E…	is Age at End of Childbearing
Age at Fi…	is Age at First Marriage
BirthInte…	is duration of Birth Interval
Breast F…	is duration of Breast Feeding
Child Mo…	is Child Mortality
Contrace…	is Contraceptive Knowledge
Current …	is current use of contraception
Education	is level of Education
Postpart…	is Postpartum Amenorrhea
Reprodu…	is Reproductive Period
Residence	is urban-rural Residence
TFR	is Total Fertility Rate
Wealth In…	is Wealth Index
Working…	is Working Status

Coefficient obtained from PLS regression will be used to verify the causal relationship and magnitude of socioeconomic, proximate determinant, and TFR. Calculation on advisable age at marriage and birth interval will be based on coefficient produced by PLS regression.

In this research, SmartPLS software will be used to calculate the PLS regression. Number of sample for bootstrap procedure is 1000. This number is selected to attain convergence when predicting t-statistics for the model.

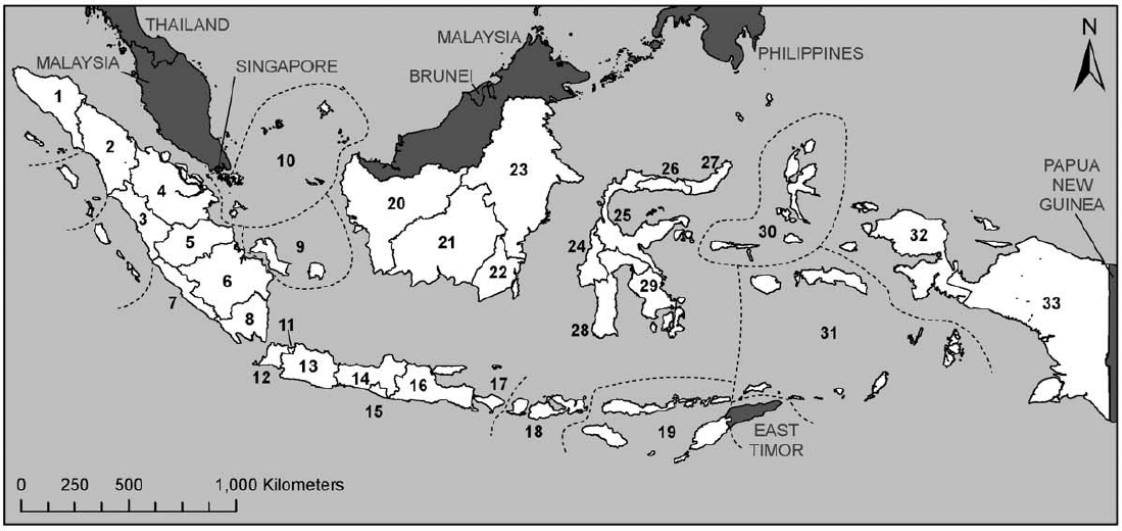
CHAPTER 4
RESULTS

4.1. Overview of Indonesia

Central Intelligence Agency (2009) gives a brief description about Indonesia as an archipelagic country of 17,508 islands (6,000 inhabited) stretching along the equator in South East Asia. Total area of Indonesia is 1,904,569 km^2. The capital city of Indonesia is Jakarta, where 8.5 million people sharing an area of 661.52 km^2. Figure 4.1 depicts 33 provinces in Indonesia. It is also could be seen from figure 4.1 that the country's strategic sea-lane position fostered inter-island and international trade. Trade fundamentally shaped Indonesian history. People of various migrations, creating a diversity of cultures, ethnicities, and languages, populate the area. The archipelago's landforms and climate significantly influenced agriculture and trade, and the formation of states.

According to the year 2000 national census, the ICBS (Indonesia Central Bureau of Statistics) report a total population of 206 million people (permanent residence: 201 million; non-permanent residence: 5 millions). This fact set Indonesia as the fourth populated country in the world following China, India, and United Stated of America. Sumatra Island covering about 20% of Indonesia population next to the most populated Java Island which covering about 60% of Indonesia population. This fact emphasizes uneven population distribution in Indonesia (ICBS, 2009).

Figure 4.1 Map of Indonesia's 33 Provinces



1	Nanggroe Aceh Darussalam	12	Banten	23	East Kalimantan
2	North Sumatera	13	West Java	24	West Sulawesi
3	West Sumatera	14	Central Java	25	Central Sulawesi
4	Riau	15	DI Yogyakarta	26	Gorontalo
5	Jambi	16	East Java	27	North Sulawesi
6	South Sumatera	17	Bali	28	South Sulawesi
7	Bengkulu	18	West Nusa Tenggara	29	Southeast Sulawesi
8	Lampung	19	East Nusa Tenggara	30	North Maluku
9	Bangka Belitung	20	West Kalimantan	31	Maluku
10	Riau Islands	21	Central Kalimantan	32	West Papua
11	DKI Jakarta	22	South Kalimantan	33	Papua

Source: IDHS (2008)

IDHS (2008) groups these 33 provinces into six regions based on their geographical location. These regions are Sumatera region, Java region, Bali and Nusa Tenggara region, Kalimantan region, Sulawesi region, and Maluku and Papua region. Sumatera region covers Nanggroe Aceh Darussalam or DI Aceh, North Sumatera, West Sumatera, Riau, Jambi, South Sumatera, Bengkulu, Lampung, Bangka Belitung, and Riau Islands. Java region covers DKI Jakarta, Banten, West Java, Central Java, DI Yogyakarta, and East Java. Bali and Nusa Tenggara region covers Bali, West Nusa Tenggara, and East Nusa Tenggara. Kalimantan region covers West Kalimantan, Central Kalimantan, South Kalimantan, and East Kalimantan. Sulawesi region covers West Sulawesi, Central Sulawesi, Gorontalo, North Sulawesi, South Sulawesi, and Southeast Sulawesi. The last region, Maluku and Papua, covers Maluku, West Papua, and Papua.

4.2. Indonesia Current Fertility Characteristic

Table 4.1 consist TFR of every province from IDHS 2007 data. From table 4.1, it could be seen that the national TFR is 2.6 per women. The highest TFR of 4.2 per women occurred in East Nusa Tenggara, while DI Yogyakarta has the lowest TFR of 1.8 per women. From the table, it also could be seen that only DKI Jakarta, East Java, and Bali which has TFR 2.1 or equal to replacement level.

Table 4.1 Indonesia Total Fertility Rate per Province 2007

Province	TFR
Sumatera	
DI Aceh	3.1
North Sumatera	3.8
West Sumatera	3.4
Riau	2.7
Jambi	2.8
South Sumatera	2.7
Bengkulu	2.4
Lampung	2.5
Bangka Belitung	2.5
Riau Islands	3.1
Java	
DKI Jakarta	2.1
West Java	2.6
Central Java	2.3
DI Yogyakarta	1.8
East Java	2.1
Banten	2.6
Bali and Nusa Tenggara	
Bali	2.1
West Nusa Tenggara	2.8
East Nusa Tenggara	4.2
Kalimantan	
West Kalimantan	2.8
Central Kalimantan	3.0
South Kalimantan	2.6
East Kalimantan	2.7
Sulawesi	
North Sulawesi	2.8
Central Sulawesi	3.3
South Sulawesi	2.8
Southeast Sulawesi	3.3
Gorontalo	2.6
West Sulawesi	3.5
Maluku and Papua	
Maluku	3.9
North Maluku	3.2
Papua	3.4
West Papua	2.9
National	**2.6**

Source: IDHS (2008)

4.3. Indonesia Current Proximate Determinants Characteristic

Chapter 3 of this research distinguishes proximate determinants into reproductive period and birth interval. Therefore, in this chapter proximate determinants will be viewed in separate table of reproductive period and birth interval related.

4.3.1. Reproductive Period Proximate Determinants

There are two variable related to reproductive periods which are age at first marriage and age at end of childbearing. The reproductive period is simply calculated from difference of age at end of childbearing subtracted by age at first marriage. Table 4.2 presents the median age at first marriage, age at end of childbearing, and reproductive period based on IDHS 2007.

Table 4.2 Indonesia Reproductive Period Proximate Determinants per Province 2007

Province	Age at First Marriage	Age at End of Childbearing	Reproductive Period
	in years	in years	in years
Sumatera			
DI Aceh	20.2	30.7	10.5
North Sumatera	22.1	31.7	9.6
West Sumatera	20.6	31.9	11.3
Riau	20.7	30.8	10.1
Jambi	19.1	29.9	10.8
South Sumatera	19.3	30.2	10.9
Bengkulu	19.3	29.8	10.5
Lampung	19.0	30.3	11.3
Bangka Belitung	20.4	29.5	9.1
Riau Islands	21.8	30.0	8.2
Java			
DKI Jakarta	22.5	30.2	7.7
West Java	18.8	29.8	11.0
Central Java	19.6	29.0	9.4
DI Yogyakarta	22.0	29.4	7.4
East Java	18.8	28.1	9.3
Banten	18.8	31.1	12.3
Bali and Nusa Tenggara			
Bali	21.3	27.2	5.9
West Nusa Tenggara	19.9	28.3	8.4
East Nusa Tenggara	21.7	32.2	10.5
Kalimantan			
West Kalimantan	20.1	28.5	8.4
Central Kalimantan	19.4	28.5	9.1
South Kalimantan	18.7	30.3	11.6
East Kalimantan	20.4	29.3	8.9
Sulawesi			
North Sulawesi	21.0	28.9	7.9
Central Sulawesi	20.0	29.4	9.4
South Sulawesi	20.5	30.5	10.0
Southeast Sulawesi	19.6	30.7	11.1
Gorontalo	20.6	27.2	6.6
West Sulawesi	19.4	30.2	10.8

Table 4.2 continued…

Province	Age at First Marriage	Age at End of Childbearing	Reproductive Period
	in years	in years	in years
Maluku and Papua			
Maluku	22.2	32.0	9.8
North Maluku	20.0	30.0	10.0
Papua	19.6	30.2	10.6
West Papua	20.5	30.2	9.7
National	**19.8**	**29.8**	**10.00**

Source: IDHS (2008)

Table 4.2 indicates DKI Jakarta as the province with the highest age at first marriage of 22.5 years, whereas South Kalimantan has the lowest age at first marriage of 18.7 years. Maluku has the highest age at end of childbearing with 32 years old. There are two provinces with 27.2 years old as the age at end of childbearing which are the lowest, there are Bali and Gorontalo. Those two provinces are also the first two provinces with the shortest reproductive period, respectively 5.9 and 6.6 years.

4.3.2. Birth Interval Proximate Determinants

Due to the availability of the data, only three variables related to birth interval is used in this research. These variables are current use of contraception, median duration of breastfeeding, and median postpartum amenorrhea. From those three variable only current use of contraception and postpartum amenorrhea which are theoretically related directly to birth interval. As described by Bongaarts and Potter (1983), duration of breastfeeding is related to birth interval through postpartum amenorrhea.

Table 4.3 Indonesia Birth Interval Proximate Determinants per Province 2007

Province	Breast Feeding	Postpartum Amenorrhea	Current use of contraception	Birth Interval
	in months	in months	in percent	in months
Sumatera				
DI Aceh	19.7	4.3	47.4	49.0
North Sumatera	18.6	5.1	54.2	31.7
West Sumatera	20.1	3.1	59.9	48.3
Riau	19.3	2.4	56.7	50.8
Jambi	24.2	3.5	65.2	68.9
South Sumatera	22.3	2.4	64.8	51.5
Bengkulu	19.5	4.2	74.0	62.3
Lampung	19.1	3.1	71.1	66.1
Bangka Belitung	4.2	3.1	67.8	56.5
Riau Islands	3.9	2.2	57.6	52.1
Java				
DKI Jakarta	19.7	2.4	60.1	56.3
West Java	21.0	2.6	61.1	66.3
Central Java	23.6	2.7	63.7	66.0
DI Yogyakarta	22.6	3.9	66.9	61.5
East Java	17.9	2.8	66.1	70.3
Banten	21.9	3.3	57.4	58.8

Table 4.3 continued...

Province	Breast Feeding in months	Postpartum Amenorrhea in months	Current use of contraception in percent	Birth Interval in months
Bali and Nusa Tenggara				
Bali	22.8	2.1	69.4	57.1
West Nusa Tenggara	19.3	4.6	54.8	55.3
East Nusa Tenggara	18.8	5.6	42.1	36.8
Kalimantan				
West Kalimantan	31.0	3.4	62.7	50.8
Central Kalimantan	16.0	2.7	66.5	57.5
South Kalimantan	23.4	2.2	64.4	58.7
East Kalimantan	18.6	2.8	59.2	49.7
Sulawesi				
North Sulawesi	18.1	2.2	69.3	58.3
Central Sulawesi	22.6	4.6	63.6	46.8
South Sulawesi	22.1	3.8	53.4	42.6
Southeast Sulawesi	21.5	5.3	50.7	37.3
Gorontalo	22.9	3.6	60.1	49.7
West Sulawesi	18.4	4.3	45.4	37.7
Maluku and Papua				
Maluku	23.0	4.3	34.1	34.2
North Maluku	13.0	5.0	48.8	42.7
Papua	20.7	3.1	38.3	42.6
West Papua	14.5	2.2	39.6	32.4
National	**20.7**	**3.1**	**61.4**	**54.6**

Source: IDHS (2008)

Table 4.3 enlightens difference in duration of breastfeeding. While most provinces have median duration of breastfeeding more than 10 months, Bangka Belitung and Riau Islands have very low duration of breastfeeding. The duration of breastfeeding on these two provinces is very extreme compared to other provinces. For the reason that geographically those two provinces are very close, there is a possibility that those two provinces have a certain culture which makes their duration of breastfeeding very short. Another fact from table 4.3 is it could be seen that West Kalimantan has the longest duration on breastfeeding.

Correlating duration on breastfeeding and postpartum amenorrhea reveals very weak relation. The Pearson correlation coefficient for these variables are 0.1, even if Bangka Belitung and Riau Islands taken out from the analysis, the Pearson correlation coefficient change to -0.1. Therefore, in this research there is not enough evidence to state that breastfeeding and postpartum amenorrhea correlate each other.

Current use of contraception is ranging from the lowest 34.1% for Maluku to the highest 74.0% for Bengkulu. While the shortest birth interval is 31.7 months for North Sumatera and the longest birth interval is 70.3 months for East Java.

4.4. Indonesia Current Socioeconomic Characteristic

Table 4.4 presents several characteristic of Indonesia socioeconomic per province related to the topic of this research. These characteristic are wealth index, education years completed by ever married women, proportion of urban-rural residence, child mortality ratio, women contraceptive knowledge, and women current working status.

Table 4.4 Indonesia Socioeconomic Characteristic per Province 2007

Province	Wealth Index	Education	Urban-Rural Residence	Child Mortality Ratio	Contraceptive Knowledge	Working Status
	percent	Years	percent	per 1000 births	in percent	in percent
Sumatera						
DI Aceh	20.0	7.3	20.0	21	96.0	52.7
North Sumatera	32.3	8.6	42.9	22	95.7	62.9
West Sumatera	26.4	8.1	28.4	16	99.3	66.9
Riau	41.6	8.0	35.5	11	97.2	48.2
Jambi	30.5	5.8	24.2	9	99.2	60.1
South Sumatera	23.6	5.7	33.7	11	99.0	68.7
Bengkulu	29.6	6.3	28.8	20	99.6	80.7
Lampung	27.2	5.8	23.4	13	99.6	69.7
Bangka Belitung	44.7	5.6	39.4	8	99.2	45.9
Riau Islands	55.4	8.2	80.1	16	98.8	36.9
Java						
DKI Jakarta	88.3	8.8	100.0	9	99.9	49.2
West Java	55.3	5.8	50.2	10	99.9	40.1
Central Java	38.5	5.7	42.0	6	99.4	63.4
DI Yogyakarta	52.6	8.7	60.2	3	100.0	71.9
East Java	41.2	5.6	41.5	10	98.5	66.3
Banten	51.2	5.7	58.4	13	99.4	43.9
Bali and Nusa Tenggara						
Bali	62.4	6.0	51.2	4	99.5	75.5
West Nusa Tenggara	27.9	5.6	35.3	21	98.1	57.4
East Nusa Tenggara	9.1	5.6	15.2	24	90.0	68.8
Kalimantan						
West Kalimantan	23.1	5.6	28.3	14	97.1	64.0
Central Kalimantan	13.9	6.6	23.6	4	100.0	57.2
South Kalimantan	18.4	5.8	35.1	19	99.3	61.7
East Kalimantan	32.7	8.2	53.3	12	99.2	50.8
Sulawesi						
North Sulawesi	29.6	8.7	35.8	9	99.7	40.0
Central Sulawesi	17.5	5.8	20.2	10	99.7	60.8
South Sulawesi	22.9	5.9	30.3	12	97.1	44.4
Southeast Sulawesi	21.0	7.8	25.2	21	97.5	57.2
Gorontalo	23.4	5.8	30.4	18	99.7	42.7
West Sulawesi	14.1	5.8	17.5	25	97.3	58.1
Maluku and Papua						
Maluku	21.7	8.1	28.3	37	93.1	45.3
North Maluku	22.0	6.5	21.1	24	97.2	51.4
Papua	32.6	4.0	31.8	25	85.1	71.9
West Papua	12.6	8.2	15.5	26	93.2	42.5
National	**40.0**	**5.8**	**42.7**	**10**	**98.6**	**57.3**

Note: The National level for child mortality rate is for 5 years preceding the survey
Source: IDHS (2008)

From table 4.4, we could see large difference on wealth index between provinces. Jakarta has the highest wealth index of 88.3%, while East Nusa Tenggara has the lowest wealth index of 9.1%.

This large difference on wealth index could be a tendency of imbalance development in Indonesia.

The education years completed by ever married women is also point out some importance facts. Some provinces have higher than 8 years education completed, with the capital city which is also a province, DKI Jakarta, is the highest with 8.8 years. While most provinces have education years completed of around 6 years, Papua have the lowest education years completed. Ever married women in Papua only have education years completed of 4 years. Since the education years completed is measured in median, it means 50% of ever married women in Papua, did not finish their primary education.

The urban-rural residence depicts how large is the urban population of each province. This could be used as indicator of information diffusion, assuming the larger the urban population the faster information exchange in the population. As DKI Jakarta is the capital city and also a province, DKI Jakarta has the most urban-rural residence of 100%, while East Nusa Tenggara has the lowest urban-rural residence of 15.2%.

The child mortality reveals some interesting points. Although as the capital city, DKI Jakarta might has a better access of health care facility but DKI Jakarta did not have the lowest child mortality rate. The facts that DKI Jakarta did not have the lowest child mortality rate might relate to affordability of health care facility. From this point of view, although a province might have a better access of health care facility, but the affordability of the health care is also important.

The lowest child mortality rate occurs in DI Yogyakarta. DI Yogyakarta has the lowest child mortality rate of 3 with next to DI Yogyakarta is Bali which has child mortality rate of 4. The highest child mortality rate is in Maluku with 37 deaths per 1000 live births. The facts that Maluku has the highest child mortality rate might due to the geography characteristics since Maluku are archipelago with many small islands. Therefore the accessibility of health care is limited.

Most provinces have very high percentage in contraceptive knowledge of more than 90%. Only Papua which has only 85.1% of women know about contraceptive. This fact might be related to education years completed which is also the lowest among provinces.

In terms of current women working status, Bengkulu has the highest percentages of 80.7%, while Riau Islands has the lowest percentages of 36.9%. The pattern of current women working status per province is very hard to be explained. Assuming education is related to working status is hardly acceptable as an explanation. Comparison on DKI Jakarta to Bali for example, reveals this fact. DKI Jakarta which has the highest women education completed of 8.8 years but only 49.2% women is currently employed while Bali which has modest women education completed of 6 years has 75.5% women is currently employed. It might be caused by opportunity to work. While works in Bali might not need education as high as the education needed to get a job in DKI Jakarta.

4.5. Relationship between Age at First Marriage, Birth Interval, and TFR

Attentive to the research objective in which finding advisable age at first marriage and birth interval to lower TFR into 2.1, therefore analyzing relationship between age at first marriage, birth interval, and TFR is important. A boxplot will be presented in order to identify extreme observation followed with scatterplot to explore relationship between these variables. Age at first marriage is not directly affecting TFR but through reproductive period, therefore scatterplot of age at first marriage to TFR could not be drawn directly. However, through relating age at first marriage to reproductive period, the relationship between age at first marriage to TFR could be seen.

The following figure 4.2 is the boxplot of age at first marriage, reproductive period, birth interval, and TFR. From figure 4.2, we could see in terms of reproductive period, observation number 17 represents Bali is identified as possible extreme observation. In terms of TFR, observation number 19 represents East Nusa Tenggara is identified as possible extreme observation. However since those two observations very slightly pass 1.5 times Inter-Quartile-Range, than this observation considered as mild outliers. Those two observations did not occur across analyzed variables as extreme observations; therefore it is safe enough to include these observations for further analysis.

Figure 4.2 Boxplot of Age at First Marriage, Reproductive Period, Birth Interval, and Total Fertility Rate

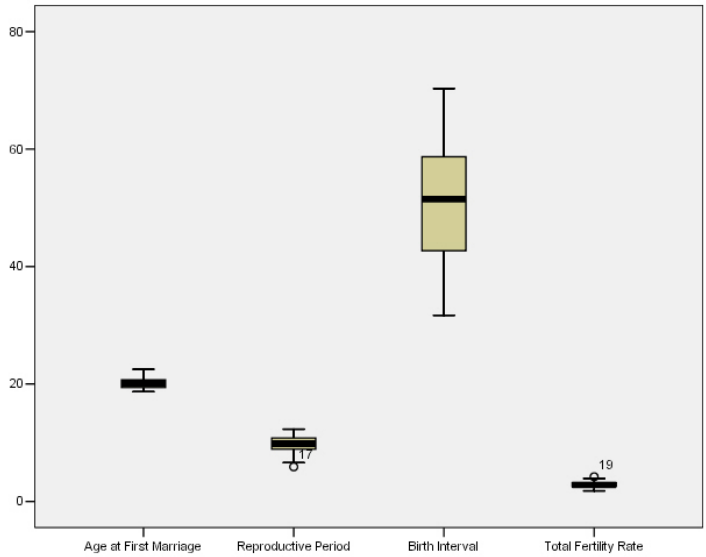


Figure 4.3 presents scatterplot between age at first marriage and reproductive period. Linear line underlines negative relationship with r-square of 0.33. It means the higher median age at first marriage will decrease reproductive period. Although it is only moderate relationship, but it should be considered as importance since this linear line only fit reproductive period by age at first marriage, ignoring age at end of childbearing.

Figure 4.3 Scatterplot Age at First Marriage to Reproductive Period

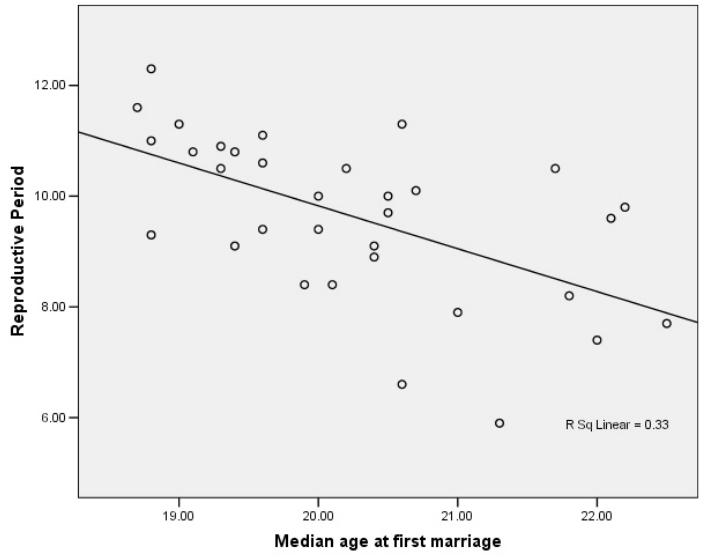


Figure 4.4 presents scatterplot between reproductive period and TFR. Linear line point out positive relationship with r-square of 0.135. It means the higher median age at marriage, the higher TFR. The scatterplot points out weak relationship. It seems the scatterplot present some observation as extreme observations, which might affect the r-square value. These observations are East Nusa Tenggara, Maluku, and North Sumatra. The r-square declines to 0.13 by excluding East Nusa Tenggara. Excluding Maluku strengthen the r-square to 0.147. The last, excluding North Sumatra strengthen the r-square to 0.177. From this step by step exclusion, there is no significant improvement to the r-square. Therefore, those observations cannot be classified as outliers and still included for further analysis to maximize information that could be captured from the data.

Figure 4.4 Scatterplot Reproductive Period to TFR

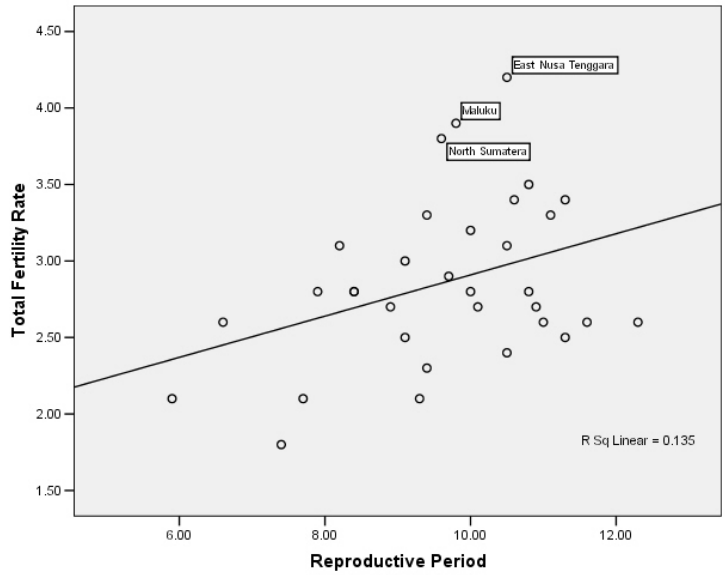
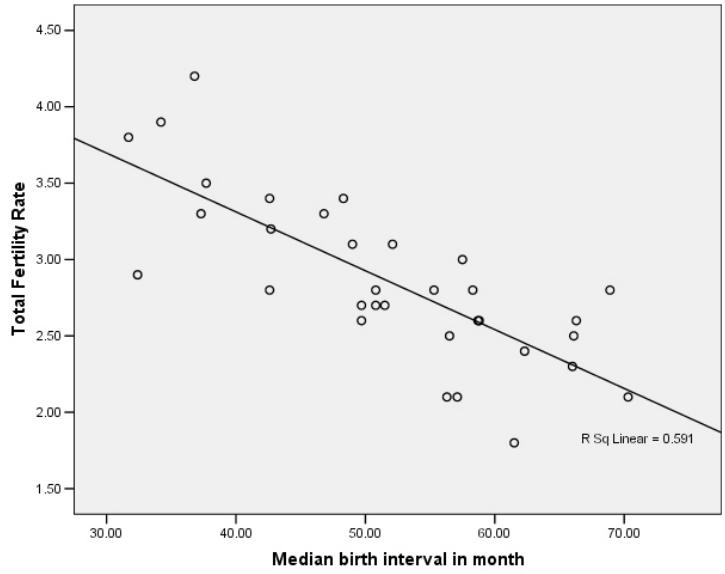


Figure 4.5 present scatterplot between birth interval and TFR. The scatterplot reveal the strongest relationship within the important variables. Linear lines demonstrate negative relationship with adequate strength r-square of 0.591, therefore the higher median birth interval, the lower TFR. The r-square indicates that the birth interval might be the strongest variable to predict TFR.

Figure 4.5 Scatterplot Birth Interval to TFR



4.6. Partial Least Square for TFR Model

This section presents path modelling through Partial Least Square (PLS) method to build TFR model. The section will be start by presenting the initial model as described in chapter 3, followed by simplified model, which is build using step by step exclusion on the most non-significant relationship. Discussion on goodness of fit of simplified model and total the effect of each socioeconomic factor to TFR also will be given.

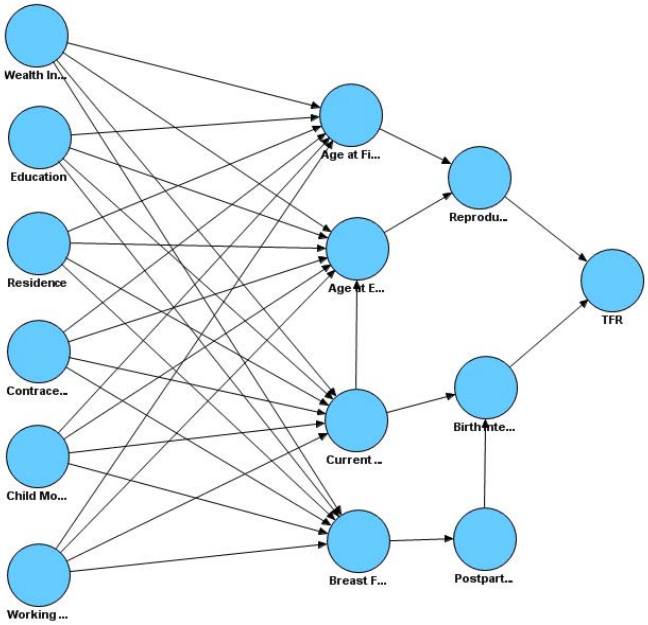
4.6.1. Initial Model

The initial model of TFR is illustrated in figure 4.6. This figure depicts causal relationship between six variables of socioeconomic, five variables of reproductive period and birth interval proximate determinants, and TFR. The socioeconomic variables are wealth index, level of education, urban-rural residence, child mortality, contraceptive knowledge, and working status. Whereas the five variables of reproductive period and birth interval proximate determinants are age at first marriage, age at end of childbearing, current use of contraception, breastfeeding, and postpartum amenorrhea. The arrows in the figure represent the direction of causal relationship, while the circles in the figure represent the variable as described in chapter 3.

Every variable of socioeconomic are each connected to age at first marriage, age at end of childbearing, current use of contraception, and breastfeeding. Therefore, every possibility of socioeconomic to proximate determinants is explored.

Some mechanism in proximate determinants also depicted in figure 4.6. These include the effect of age at first marriage and age at end of childbearing to reproductive period; the effects of current use of contraception to age at end of childbearing and birth interval; and the effects of breastfeeding to birth interval through postpartum amenorrhea.

Figure 4.6 Initial Model of TFR



T-statistics of every causal relationship in the initial model are evaluated. An the effect of a variable are considered significant if it has a significant level of 95% or equal to p-value less than 0.05. Table 4.5 gives the t-statistic and p-value of each causal relationship in the initial model. From table 4.5, not all causal relationship is significant. Significant causal relationship in this initial model is the effects of education to age at first marriage, child mortality to current contraceptive knowledge, contraceptive knowledge to current use of contraception, working status to current use of contraception, age at end of childbearing to reproductive period, age at first marriage to reproductive period, current use of contraception to birth interval, birth interval to TFR, and reproductive period to TFR.

Table 4.5 t-statistic and p-value of Initial Model

Variable Groups	Relationship	T Statistics	p-value	
Socio	Wealth Index -> Age at End of Childbearing	0.06	0.95	
Economic	Wealth Index -> Age at First Marriage	0.18	0.86	
	Wealth Index -> Breast Feeding	0.08	0.93	
	Wealth Index -> Current use of contraception	0.01	0.99	
	Education -> Age at End of Childbearing	1.45	0.15	
	Education -> Age at First Marriage	4.06	0.00	*
	Education -> Breast Feeding	0.40	0.69	
	Education -> Current use of contraception	0.88	0.38	
	Residence -> Age at End of Childbearing	0.08	0.93	
	Residence -> Age at First Marriage	0.70	0.49	
	Residence -> Breast Feeding	0.11	0.91	
	Residence -> Current use of contraception	0.09	0.93	
	Child Mortality -> Age at End of Childbearing	0.74	0.46	
	Child Mortality -> Age at First Marriage	0.29	0.77	
	Child Mortality -> Breast Feeding	0.03	0.97	
	Child Mortality -> Current use of contraception	2.44	0.02	*
	Contraceptive Knowledge -> Age at End of Childbearing	0.19	0.85	
	Contraceptive Knowledge -> Age at First Marriage	2.00	0.05	
	Contraceptive Knowledge -> Breast Feeding	0.40	0.69	
	Contraceptive Knowledge -> Current use of contraception	4.58	0.00	*
	Working Status -> Age at End of Childbearing	0.57	0.57	
	Working Status -> Age at First Marriage	0.28	0.78	
	Working Status -> Breast Feeding	1.87	0.06	
	Working Status -> Current use of contraception	2.40	0.02	*
Proximate	Age at End of Childbearing -> Reproductive Period	7.09	0.00	*
Determinants	Age at First Marriage -> Reproductive Period	6.15	0.00	*
	Breast Feeding -> Postpartum Amenorhea	0.70	0.48	
	Current use of contraception -> Age at End of Childbearing	0.73	0.47	
	Current use of contraception -> Birth Interval	7.12	0.00	*
	Postpartum Amenorhea -> Birth Interval	1.62	0.11	
	Birth Interval -> TFR	10.24	0.00	*
	Reproductive Period -> TFR	3.27	0.00	*

Note: * = significant

4.6.2. Simplified Model

Since from table 4.5 only some causal relationship that significant, a simplified model would be beneficial. The simplified model will not include all the causal relationship between variable but only those, which are significant. Systematically exclusion of each causal relationship, which are not significant, and have the less t-statistics will be proceed to select significant causal relationship only while keeping the highest possible goodness of fit.

Within the analysis, there were 22 steps should be done to obtain a simplified model. These step start with exclusion the effect of wealth index to current use of contraception, and ended with the exclusion of education the effect to end of childbearing. Table 4.6 summarized the t-statistic and p-value of each causal relationship in the simplified model.

Table 4.6 t-statistic and p-value of Simplified Model

Variables Groups	Relationship	T Statistics	p-value	
Socio	Education -> Age at First Marriage	6.5005	0.00	*
Economic	Child Mortality -> Current use of contraception	3.2012	0.00	*
	Contraceptive Knowledge -> Current use of contraception	5.6118	0.00	*
	Working Status -> Breast Feeding	2.6841	0.01	*
	Working Status -> Current use of contraception	2.7412	0.01	*
Proximate	Age at First Marriage -> Reproductive Period	6.5544	0.00	*
Determinants	Age at End of Childbearing -> Reproductive Period	7.8099	0.00	*
	Current use of contraception -> Age at End of Childbearing	4.7084	0.00	*
	Current use of contraception -> Birth Interval	15.8202	0.00	*
	Reproductive Period -> TFR	3.1025	0.00	*
	Birth Interval -> TFR	10.4171	0.00	*

Note: * = significant

From table 4.6, it could be seen that only 11 causal relationships is retained in the simplified model. The 11 causal relationships are (1) the effect of education to age at first marriage, (2) the effect of child mortality to current use of contraception, (3) the effect of contraceptive knowledge to current use of contraception, (4) the effect of working status to breastfeeding, (5) the effect of working status to current use of contraception, (6) the effect of age at first marriage to reproductive period, (7) the effect of age at end of childbearing to reproductive period, (8) the effect of current use of contraception to age at end of childbearing, (9) the effect of current use of contraception to birth interval, (10) the effect of reproductive period to TFR, and (11) the effect of birth interval to TFR.

The coefficient of the effect of each variable and r-square of each causal relationship is illustrated in figure 4.7. Partial Least Square regression use standard normal distribution, therefore all coefficient is beta coefficient. Using beta coefficient, direct comparison on which independent variables that has greater power to dependent variable is possible although these independent variables are measured in different unit of measurement. The number above the arrows represents the coefficient and the number inside the circles represents the r-square of each equations.

Figure 4.7 Simplified Model of TFR

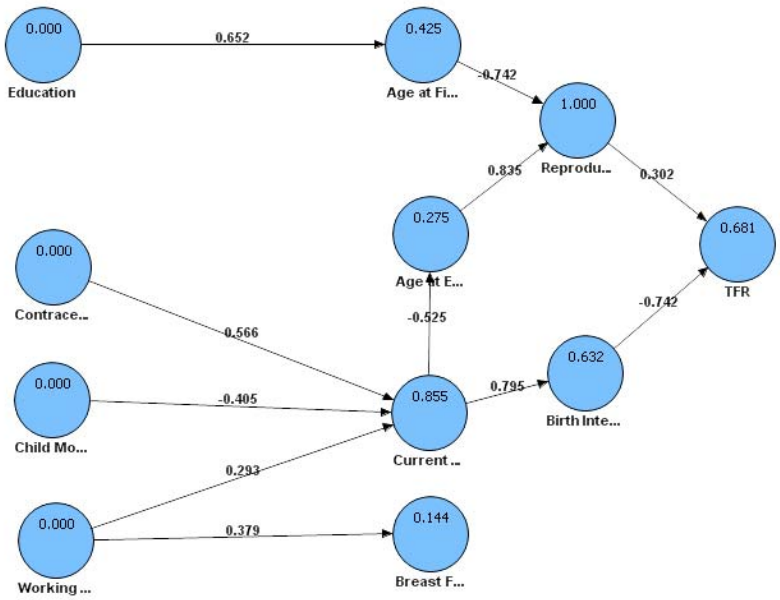


Figure 4.7 present only four variable of socioeconomic that related to proximate determinants. These variables are education, contraceptive knowledge, child mortality and working status. Education has positive the effect toward the age at first marriage (0.652). Therefore, higher median year of completed education will increase the age at first marriage. Figure 4.7 underlines the important of current contraceptive knowledge as the gateway of socioeconomic variable the effect toward TFR. Three variables are affecting the current use of contraception. These are contraceptive knowledge, child mortality, and working status. From those three variables, contraceptive knowledge has the strongest the effect toward current use of contraception (0.566), followed by child mortality (-0.405), and working status (0.293). Contraceptive knowledge and working status have positive the effect toward current use of contraception. As a result, the higher contraceptive knowledge and the higher percentage of women working will promote higher current use of contraception. Child mortality has negative the effect toward current contraceptive knowledge. For that reason, the higher child mortality will decrease the current use of contraception. Although working status is affecting duration of breastfeeding (0.379) but there is no sufficient prove that the duration of breastfeeding affects other variables. Postpartum amenorrhea also eliminated from the simplified model. This result strengthen the reason to classify Indonesia as modern developed society as Bongaarts and Potter (1983) states that in modern developed society, birth interval is much more affected by contraception rather than postpartum infecundability or postpartum amenorrhea.

From figure 4.7, it could be seen that current use of contraception has negative the effect toward age at end of childbearing (-0.525). Therefore, the higher current use of contraception knowledge will decrease age at end of childbearing. The effect of current use of contraception to birth interval even stronger compared to the effect toward age at end of childbearing (0.795).

The effect of age at end of childbearing is the strongest between two variables that the effecting reproductive period (0.835). Whereas age at end of childbearing has positive the effect to reproductive period (0.835), age at first marriage has negative the effect to reproductive period (-0.742). Therefore the higher age at first marriage will shortened the reproductive period but the higher age at end of childbearing will extend the reproductive period.

Between reproductive period and birth interval, the birth interval has higher the effect toward TFR (0.302 vs. -0.795). In could be seen from figure 4.7 that reproductive period has positive the effect to TFR (0.302), while birth interval has negative the effect to TFR (-0.795). Consequently, the higher reproductive period will increase TFR, and the higher birth interval will decrease TFR.

Transforming beta coefficient for reproductive period and birth interval into unstandardized coefficient reveals that for every one year increment in reproductive period will increase the TFR by 0.110, and for every one month increment in birth interval will decrease the TFR by 0.037. Underlines the negative relationship between age at first marriage to reproductive period in figure 4.3 and since reproductive period is purely mathematical difference between age at end of childbearing and age at first marriage, then for every one year increment in age at first marriage will decrease the TFR by 0.110. The transforming process from beta coefficient for reproductive period and birth interval into unstandardized coefficient could be found in the Appendix V.

4.6.3. Goodness of Fit

Figure 4.7 also depict the r-square of each equation in the model. The r-square indicate the goodness of fit for each equation forming the model.

Age at first marriage has r-square of 0.425. It means 42.5% variability in age at first marriage could be explained by the women duration of completed education. Age at end of childbearing has r-square of 0.275. It means only 27.5% variability in age at end of childbearing could be explained by current use of contraception. This low explained variability might be caused by the absent of induced abortion which Bongaarts and Potter (1983) mention as the component that related to early end of childbearing in modern society. Current use of contraception has the highest r-square of 0.855. It means contraceptive knowledge, child mortality, and working status could explain 85.5% variability in current use of contraception. It also presents that only 14.5% variability in current use of contraception which could not be captured through contraceptive knowledge, child mortality, and working status. In case of duration of breastfeeding, working status could explain only 14.4% variability as shown in r-square of 0.144. It point out that 85.6% variability still not explained or in

another words means that many factor beside working status which affecting the duration of breastfeeding are not captured in the model.

Since reproductive period is pure mathematical function of age at end of childbearing subtracted by age at first marriage, therefore 100% of variability in reproductive period should be explained by age at first marriage and age at end of childbearing. The fact is confirmed in the model, which show reproductive period r-square of 1.00. The birth interval has r-square of 0.632. It points out that by including current use of contraception only, 63.2% variability in birth interval could be explained.

The essential information, which also concludes the goodness of fit of the model, is shown in TFR r-square. TFR has r-square of 0.681. This r-square is considered high since 68.1% variability in TFR could be explained by reproductive age and birth interval. On another words, it means in case of Indonesia only 31.9% variability in TFR which could not be explained by reproductive age and birth interval. This unexplained variability might be related to the fact that the model measure TFR in province level. The lost of inner variability due to the median measurement in reproductive period and birth interval might also contribute to the unexplained variability.

4.6.4. Total effect of Socioeconomic Variable

Total effect of each socioeconomic variable to TFR could be compute from path coefficients depicted in figure 4.7. Table 4.7 summarized each total the effect of four socioeconomic variables to TFR.

Table 4.7 Total The effect of Socioeconomic to TFR

Variables	Total The effect
Contraceptive Knowledge	-0.409
Child Mortality	0.293
Working Status	-0.212
Education	-0.146

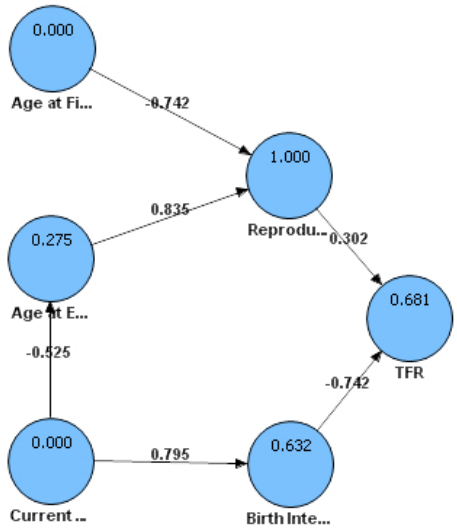
From Table 4.7, it could be seen that contraceptive knowledge has the highest total the effect to TFR (-0.409). Contraceptive knowledge total the effect is negative, it means that the higher contraceptive knowledge will decrease TFR. Child mortality attain the second highest total the effect. Different from other variable, which has negative total the effect to TFR, child mortality has positive total the effect. It means the higher child mortality, will increase TFR. Working status and education are the two lowest variable regarding total the effect to TFR, each are -0.212 and -0.146.

Taking notes on these socioeconomic total the effect leads into conclusion that in order to lower TFR, effort to increase contraceptive knowledge should be placed as the first priority followed consecutively by reducing child mortality, open more opportunity for women to work, and open more opportunity for women to attain higher education.

4.7. Selecting Advisable Age at First Marriage and Birth Interval

This section will discuss the advisable age at marriage and birth interval in order to achieve TFR of 2.1. The age at marriage in this research means the age at first marriage. The calculation will be based on endogenous part of simplified model, which only include age at first marriage, age at end of childbearing, current use of contraception, reproductive period, birth interval, and TFR. For illustrative purpose, the inner side of simplified model and coefficients of the model is drawn in figure 4.8.

Figure 4.8 Endogenous Part of Simplified Model



There are three scenarios that will be discussed in which two of them are the extreme condition and one is subjective selection of birth interval.

The two extreme conditions are (1) reproductive period of 33 provinces remain the same, (2) birth interval of 33 provinces remain the same. The subjective selection scenario of birth interval will select birth interval of 60 months. These due to the fact that (1) current birth interval at national level is already 54.6 months, (2) from section 4.6, it could be seen that birth interval have stronger the effect toward TFR compared to reproductive period, (3) 60 months which could be communicated as five year is easier to remember once it is implemented in family planning program.

Due to the standard normal distribution that Partial Least Square regression use, to start the process of selecting advisable age at first marriage and birth interval, mean and standard deviation of age at first marriage, age at end of childbearing, current use of contraception, reproductive period, birth interval, and TFR should be compute.

Table 4.8 summarized the 33 provinces mean and standard deviation of these variables.

Table 4.8 Mean and Standard Deviation of Endogenous Variables

Variables	Mean	St.Dev
Age at Marriage	20.24	1.10
Age at End of Childbearing	29.88	1.23
Current use of contraception	58.07	10.08
Reproductive Period	9.64	1.48
Birth Interval	51.72	10.81
TFR	2.86	0.54

Using mean and standard deviation from table 4.8, standardize normal for TFR could be computed through the following z-score equation. By using this z-score equation, every variables value in TFR model can be transformed into statistical standard normal distribution $N(0, 1)$ which has mean of zero and standard deviation of one.

$$z = \frac{x - \bar{x}}{s} \quad (4.1)$$

Whereas:

z is z-score
x is value of observed variable
$\bar{x}$ is mean
s is standard deviation

Therefore z-score for TFR of 2.1 is:

$$z = \frac{2.1 - 2.86}{0.54}$$
$$z = -1.40$$

The computations of the following three scenarios are based on this z-score TFR of -1.40. For each variable unstandardized value or value of observed variable could be compute reverse using equation 4.1.

4.7.1. Scenario One: Reproductive Period of 33 Provinces Remain the Same

Assuming reproductive period remain the same, then z-score for reproductive period is equal to zero. Therefore, calculation of birth interval would be possible. By using step by step substitution on equations in endogenous part of simplified model, value of current use of contraception, age at end of childbearing and age at marriage could be obtained.

Table 4.9 summarized these computations. These computations reveal that if reproductive period of 33 provinces remain the same, then to achieve TFR of 2.1, birth interval should be 72.17 months (around 6 years), current use of contraception should be 82.07%, age at end of childbearing will be 28.34 years, and age at first marriage will be 18.70 years.

Table 4.9 Scenario One Computation: Reproductive Period of 33 Provinces Remain the Same

Compu-tation	Variable		Coefficient	Variable		Coefficent	Variable	Result
1	TFR			Birth Interval			Reproductive Period	Unstandardized Birth Interval
z-score	-1.40	=	-0.742	1.89	+	0.302	0	72.17 Months
2	Birth Interval			Current use of contraception				Unstandardized Current Contraceptive
z-score	1.89	=	0.795	2.38				82.07 Percent
3	Age at End of Childbearing			Current use of contraception				Unstandardized Age at End of Childbearing
z-score	-1.25	=	-0.525	2.38				28.34 Years
4	Reproductive Period			Age at First Marriage			Age at End of Childbearing	Unstandardized Age at First Marriage
z-score	0.00	=	-0.742	-1.41	+	0.835	-1.25	18.70 Years

From the computation it could be seen a high requirement to leverage current use of contraception from national level of 61.4% to 82.07%. The computation on scenario one also point out that the age at first marriage will be lower compared to national level age at first marriage (18.7 years vs 19.8 years). While high requirement to leverage current use of contraception is very demanding and lower age at first marriage will not likely occur in the future, scenario one is less expected to be the solution to achieve TFR of 2.1.

4.7.2. Scenario Two: Birth Interval of 33 Province Remain the Same

In scenario two, birth interval of 33 provinces is assumed remain the same. Therefore, the z-score for birth interval is equal to zero. As the consequences, the z-score for current use of contraception and age at end of childbearing is also zero. Within this assumption calculation of reproductive period, age at first marriage, and age at end of birth interval would be possible.

Table 4.10 summarized these computations. From table 4.10, it could be seen that if birth interval of 33 provinces remain the same, then to achieve TFR of 2.1, reproductive period required being as short as 2.77 years and age at first marriage required to be as high as 27.11 years. By adding reproductive period and age at first marriage, age at end of childbearing would be 29.88 years, which is slightly higher than national level of 29.8 years.

Table 4.10 Scenario Two Computation: Birth Interval of 33 Province Remain the Same

Compu-tation	Variable		Coefficient	Variable		Coefficent	Variable	Result	
1	TFR			Birth Interval			Reproductive Period	Unstandardized Reproductive Period	
z-score	-1.40	=	-0.742	0	+	0.302	-4.647	2.77	Years
2	Reproductive Period			Age at First Marriage			Age at End of Childbearing	Unstandardized Age at Marriage	
z-score	-4.65	=	-0.742	6.26	+	0.835	0	27.11	Years

For the reason that the reproductive period is very short and age at first marriage is very high, scenario two also seems has small possibility to be applied as the solution to achieve TFR of 2.1.

4.7.3. Scenario Three: Birth Interval of 60 months

Scenario three presents selection of 60 months birth interval. By using the equation 4.1, z-score of birth interval will be 0.77. Step by step substitution of equations in endogenous part of the model will offer the reproductive period, age at first marriage, age at end of childbearing, and current use of contraception.

The computation of scenario three is summarized in table 4.11. From table 4.11, it could be seen that if birth interval is 60 months, to achieve TFR of 2.1, reproductive period required being 5.55 years and current use of contraception required being 67.79%. Therefore, age at end of childbearing would be 29.25 years, and the age at first marriage is 23.70 years.

Table 4.11 Scenario Three Computation: Birth Interval of 60 months

Compu-tation	Variable		Coefficient	Variable		Coefficient	Variable	Result	
1	TFR			Birth Interval			Reproductive Period	Unstandardized Reproductive Period	
z-score	-1.40	=	-0.742	0.77	+	0.302	-2.765	5.55	Years
2	Birth Interval			Current use of contraception				Unstandardized Current Contraceptive	
z-score	0.77	=	0.795	0.96				67.79	Percent
3	End of Childbearing			Current use of contraception				Unstandardized Age at End of Childbearing	
z-score	-0.51	=	-0.525	0.96				29.25	Years
4	Reproductive Period			Age at First Marriage			Age at End of Childbearing	Unstandardized Age at First Marriage	
z-score	-2.76	=	-0.742	3.15	+	0.835	-0.51	23.70	Years

Although the requirement for reproductive period is almost half the actual national reproductive period (5.55 years vs 10 years), but it might be achievable since Bali already have reproductive period of 5.9 years. Requirement for current use of contraception in scenario three is also lower compared to the requirement in scenario one (67.79% vs 82.07%). This requirement is also not too demanding compared to actual national current use of contraception, which is already 61.4%. In scenario three, current use of contraception will check age at end of childbearing to be 29.25 years. A leap on age at marriage is required since actual age at marriage in national level is still 19.8 years and there is still no province, which has age at first marriage near 23.7 years. However, by open more opportunity for women to attain higher education might accommodate this leap. A note should be made that the age at first marriage, age at end of childbearing, and reproductive period is measured as median from province, therefore it is possible for a woman to have two children or more although the reproductive period is 5.55 years and birth interval is 60 months or 5 years.

From comparison of scenario three above and the actual situation in Indonesia as described in section 4.3, the scenario three is probable to be more achievable scenario compared to scenario one and two.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The objectives of this research are to find advisable age at first marriage and birth interval in order to achieve TFR of 2.1. The socioeconomic factor also analyzed to find socioeconomic variable that could be utilized to ensure TFR of 2.1.

Through the analysis and result, which are presented in chapter 4, the answer to these objectives is revealed. The following is the answer of the specific research questions mentioned in chapter 1.

First, based on IDHS 2007, the current Indonesia national fertility is 2.6 which still far from TFR 2.1. In national level, 50% of Indonesian women married before 19.8 years old and end their reproductive carrier 10 years after at age 29.8 years old. Indonesian women gave breastfeeding of 20.7 months period, experienced postpartum amenorrhea for 3.1 months, and gave birth within 54.6 months birth interval. National current use of contraceptive is 61.4%. In national level, only 40% household that have wealth index of fourth and highest. Ever married women in Indonesia have median education of 5.8 years only. It means 50% of ever married women never finish their primary education. National percentage of household member living in urban area is 42.7%. National Child Mortality Ratio is 10 deaths per 1000 live births, but there is enormous difference between provinces ranging from 3 deaths per 1000 live births in Yogyakarta to 37 deaths per 1000 live births in Maluku. National contraceptive knowledge is 98.6%, which is very high, only in Papua the contraceptive knowledge is as low as 85.1%. IDHS 2007 presents that in national level 57.3% of Indonesian women currently employed.

Second, there are six socioeconomic variables analyzed in this research, which are wealth index, level of education, urban-rural residence, child mortality, contraceptive knowledge, and working status. From these six variables only four variables that significantly affect proximate determinants. Figure 4.7, simplified model for TFR, depicts this result. From figure 4.7, it could be seen that education has positive the effect to age at first marriage with coefficient of 0.652. Therefore, the higher the education, the later age at first marriage will likely occur. Contraceptive knowledge, child mortality, and working status affect current use of contraception with coefficient of each 0.566, -0.405, and 0.293. Thus, higher contraceptive knowledge will enhance current use of contraception; lower child mortality will raise current use of contraceptive, and more women with working status will increase current use of contraception.

Third, age at first marriage has negative the effect to reproductive period (-0.742). It means the higher age at first marriage will reduce the reproductive period. Reproductive period has positive the effect to TFR (0.302). Therefore, the longer the reproductive period, the higher the TFR would be. Relating age at first marriage to TFR will result negative total the effects of -0.224. Consequently, the higher age at first marriage will lower the TFR. Since birth interval has negative the effect to TFR (-0.742), then the longer the birth interval will lower the TFR.

Fourth, based on simplified model of TFR, three scenario of advisable age at first marriage and birth interval was analyzed. Scenario one of which reproductive period of 33 provinces remains the same, require 72.17 months birth interval, 82.07% current use of contraception, age at first marriage of 18.70 years old, and end of childbearing of 28.34 years old . Scenario two of which birth interval of 33 provinces remains the same, require reproductive period of 2.77 years, age at first marriage of 27.11 years old, and age at end of childbearing of 29.88 years old. Scenario three of which birth interval of 60 months, require current use of contraception 67.79%, reproductive period of 5.55 years, age at first marriage 23.7 years old, age at end of childbearing 29.25 years old. Scenario three is the most feasible scenario to lower TFR since (1) birth interval of 60 months is close to current national birth interval (54.6 months), (2) reproductive period of 5.55 years is next to province with the current lowest reproductive period, Bali (5.9 years), (3) 67.79% current use of contraception is only slightly higher compared to the national current use of contraception (61.4%), (4) age at first marriage of 23.7 years old, although far from current national age at first marriage of 19.8 years old, but it is still achievable by open more opportunity for women to attain higher education. Therefore, based on scenario three, to lower the TFR to 2.1, the advisable age at first marriage is 23.7 years old and the advisable birth interval is 60 months or five years.

5.2. Recommendation

To ensure achievability age at first marriage of 23.7 years old and birth interval of five years, Indonesia government could utilize four socioeconomic variables. Based on table 4.7, total effect of socioeconomic to TFR, effort to increase contraceptive knowledge (-0.409) should be put as the first priority, followed by reducing child mortality (0.293), open more opportunity for women to work (-0.212), and encourage women to attain higher education (-0.146).

In field implementation, the NFPCB should now have advisable age at first marriage of 23.7 years old and birth interval of five years to promote in their '4T Preventing Program'. It might be difficult to advise age at first marriage of 23.7 years, which is far from current national age at marriage. Therefore, a softer approach is to encourage women to attain higher education, as it is shown in TFR model that education level determines the age at first marriage. To encourage women to attain higher education, the government could lower the tuition fee in public school or might even give a free tuition fee for women and give more scholarship for women to attain higher education. Priority on women empowerment to attain higher education should be given to provinces with low education level such as Papua.

The government could encourage Indonesia family to have birth interval of five years by giving childbearing cost waiver for children born within five years birth interval if the children are born in public hospital or by the help of village midwife. However, since birth interval is mainly affected by current use of contraceptive, therefore the government should increase the availability and accessibility of contraceptive. In IDHS 2007, it is reported that in Indonesia there were 9% ever married women who want to maintain birth interval or end their childbearing but still not using any method of contraceptive unmet need of family planning. Therefore, this women segment with unmet need of family planning, should be given first priority.

To increase contraceptive knowledge and maintaining this contraceptive knowledge high, NFPCB should do continuously conduct campaign on contraceptive knowledge using types of media such TV, Radio, Internet, etc. NFPCB could also give information on reproductive health to high school student continually, therefore not only women but also men aware of reproductive health includes contraceptive knowledge.

Reducing child mortality should be done also to make sure lower TFR. Related to population growth, child mortality might lower the number of total population but it is not ethical to let child mortality to reduce population growth. From the TFR model, it has been shown that TFR will decrease if the child mortality also decreases. Hence, the effort to reduce child mortality is not only ethical but also not increase the population growth. To reduce child mortality, the government should manage the availability and the accessibility of health care facilities. '4T Preventing Program' should also include information on infant and maternal health to prevent child mortality in later stages.

From TFR model, it is also confirmed that higher proportion of women are working will produce lower TFR. Therefore, the government should open more opportunity for women to work. This could be done by giving a certain quota for women to work in government sector, give tax reduction for private sector that employs certain quota of women, give tax reduction for women who work as a professional.

For further research, TFR in this research is period TFR which might affected by age composition. It might be beneficial to seek if there is an effect of age composition in TFR model and how to overcome this problem. Furthermore, this research was conducted using aggregate data from each province in Indonesia. Therefore, there is a possibility that less information captured. Individual level research using the same set variables should be beneficial to capture maximum information. However, for this type of micro level research, TFR should be replaced with other fertility outcomes, e.g. Children Ever Born (CEB). Bongaarts and Potter (1983) also mention that the contraceptive effectiveness also have an important rules in determining fertility outcomes. This statement is not covered during this research. For further research, a model of fertility outcomes could integrates analysis of this statement.

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