

VARIATIONS IN PATTERNS OF LOW FERTILITY IN SOUTH
KOREA IN 2004: A COUNTY LEVEL ANALYSIS

A Thesis

by

JUNGWON YOON

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

August 2006

Major Subject: Sociology

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ABSTRACT

Variations in Patterns of Low Fertility in South Korea in 2004:

A County Level Analysis. (August 2006)

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Chair of Advisory Committee: Dr. Dudley L. Poston, Jr.

Since the early 1960s, South Korea has been going through a rapid fertility decline, along with its socioeconomic development and effective family planning programs. After achieving a desired replacement level of fertility in 1984, the total fertility rate (TFR) of Korea has gradually declined to the level of lowest-low fertility. According to 2004 vital statistics, the TFR for Korea was 1.16—below the lowest-low fertility level of 1.3. Also, Korea's fertility rates have fluctuated and varied spatially, even at the level of low fertility.

Undoubtedly, Korean family planning programs have been effective in population control through the last 40 years, but since 2000, the shift to pro-natal policies indicates that Korea's fertility transition is no longer a response to family planning policies. Rather, the level of socioeconomic development is still considered to have a significant effect on Korea's fertility decline. Thus, in this thesis, the primary objective is to examine the socioeconomic determinants of fertility differentials and the variation in low fertility among the counties in South Korea in 2004. Using data from the 2000 census and 2004 vital statistics, I tested the hypothesized relationships between the level of socioeconomic development and fertility based on the demographic

transition theory (DTT), by estimating several Ordinary Least Square (OLS) multiple regression models.

Specifically, socioeconomic predictors, such as agricultural attainment, labor force participation, and educational attainment, were primarily examined to test the validity of the DTT hypotheses. In addition, this thesis also examined the effects of women's status and traditional norms and cultural values on variation in fertility. My results showed that the DTT is applicable to an accounting of the variance in fertility rates among the Korean counties in 2004. Although the levels of fertility are extremely low all across the country, it is apparent that socioeconomic conditions are having an impact on fertility differentials in Korea.

To my parents,
for their love and full-hearted support

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CHAPTER I

INTRODUCTION

South Korea, with a population of over 47 million, has experienced a remarkable decline in fertility. The demographic revolution which began in the country in the 1960s, marked by rapid socioeconomic development, caused a transition that, over time, dramatically changed the fertility rates: between 1960 and 1983 the total fertility rate (TFR) of South Korea fell from 6.0 to the replacement level fertility of 2.1 (see **FIGURE 1**). In the mid 1980s, the TFR of South Korea was even lower than that of most western European countries. In 2004, the TFR of South Korea declined to 1.16, making it the lowest fertility rate in the world.

In addition to this fertility decline, the mortality level of Korea has also drastically declined over time. The crude death rate per 1,000 Koreans decreased from 16 in 1960 to 5.1 in 2004 (see **FIGURE 2**). This rapid demographic transition provides tremendous momentum for the current rate of population aging in South Korea. Consequently, low fertility not only brought about the depopulation of the country, but also an increase in the elderly population and a decrease in the working-age population. These elements together expose various socioeconomic problems currently affecting South Korea.

The rapid decline in fertility in Korea was due mainly to socioeconomic development and a “very successful” adoption of the government-led family planning

programs. Since the 1960s, South Korea's rapid economic development has been hailed as one of the most successful in the developing world. Before 1961, the level of economic development was very low and population growth was high, resulting in prevalent poverty throughout the country (Cho and Lee 1999). However, 16 May 1961 marked a turning point in modern Korean history. On that day, General *Park Chung Hee* led a military coup which brought an end to a corrupt and inept government and achieved significant economic development. Under the leadership of Park's administration, the Economic Planning Board (EPB) was founded on 22 July 1961, only two months after the coup. This became the nerve center of Park's plan to promote economic development. Economic programs of rapid industrialization based on exports were launched. These Korean governmental efforts were reflected in the First Five-Year Economic Development Plan (1962-66), and the subsequent Second (1967-71), Third (1972-76), Fourth (1977-81) and Fifth (1982-86) five year economic development plans.

During the first five-year economic development plan, Korea's gross domestic product (GDP) expanded at an annual rate of 7% and continued to grow rapidly. In 2004, Korea's GDP size ranked 10th in the world at \$680 billion, which is a substantial increase from the \$4 billion recorded in 1960. The escalation marks a growth of approximately 167 times the original size in only 44 years. South Korea's miraculous achievement is one of the most remarkable economic development stories of the twentieth century.

At the same time, the Korean government launched a full-scale national family planning program in 1962, along with a series of five-year economic development plans,

all of which have been very effective in controlling the country's previously high rate of fertility (I. K. Kim 1987). The Korean government actively campaigned for a family planning program because it was believed that the expanding population was undermining economic prosperity. Thus, national family planning programs were vigorously implemented throughout the successive five-year economic development plans, with demographic targets of reducing the annual population growth rate and the total fertility rate of the country (Cho and Lee 1999). According to Yang (1991), "the main reasons for adopting the categorical family planning approach were: 1) the urgency of the population problem required that family planning be given priority over other health programs, such as tuberculosis control and maternal and child health: 2) development of the maternal and child health program in Korea was in an infant stage, and it would have taken too much time and cost to develop: 3) the maternal and child health program would have claimed the majority of the limited available budget" (Cho and Lee 1999: 32).

In 1971, the Korean Institute for Family Planning was established in an attempt to eliminate cultural preferences for male children and to reduce fertility rates to a target level of 2.1. The government emphasized high initial rates of contraceptive use and small families, both of which have been major components in the decline in fertility; however, participation in the programs was voluntary. There were also special programs for the urban poor, including postpartum contraceptive distributions and financial incentives for acceptors of sterilization (Choe et al. 2005). Since these new and simple methods of female sterilization were introduced in 1974, sterilization has become the

most popular form of contraception (Choe et al. 2005). As a result of this governmental effort, the use of contraceptives has increased from 44.2 percent in 1976 to 77.1 percent in 1988 (Cho and Lee 1999).

During the 1970s, the well-known family planning slogans “Regardless of sons or daughters, stop at two and raise them well” and “A well bred girl surpasses ten boys” spread throughout the country via mass media public campaigns. A 2-child family norm was further facilitated by the consistent enforcement of Korean governmental policies directed at controlling population growth. Consequently, the TFR of Korea in 1984 reached 1.76, which was the first time in Korean history that the TFR fell below the replacement level. Having achieved significant decreases in population growth and fertility, the Korean government then turned to a more moderate population policy, reducing the annual sterilization targets in 1986 from 300,000 to 60,000 by 1991.

Although the national family planning programs achieved the desired replacement level of fertility by the mid 1980s, Korean population policies continued to encourage small family size by “broadening economic incentives for sterilization acceptors with one or two children, and limiting family allowance and other benefits to two children” (Choe et al. 2005: 6). In 1986, the family planning programs began promoting one-child families with the slogan: “Even two children for a family is too many for over-crowded Korea.” Consequently, even after the achievement of the desired replacement level of fertility, the TFR of Korea continued to decline to far below the replacement level of fertility.

After the mid 1980s, sex-selective abortion was widely used, producing a severe imbalance in the sex ratio of live births. The Korean government legalized induced abortions under certain conditions for medical reasons and allowed paramedical intra-uterine device insertion in 1973 (Cho and Lee 1999). Both factors played an important role in maintaining both a preference for male children and below replacement levels of fertility during the 1980s. When the use of the ultrasound for antenatal examinations became widely available, Korean women with a strong desire to have a son began relying on induced abortion to terminate unwanted pregnancies (Choe et al. 2005). The TFR fell from 2.83 in 1980 to 1.59 in 1990, and the sex ratio at birth increased from 105.3 to 116.5.

Given the above, Korea's population policies began focusing on the elimination of the cultural preference for male children and sex-selective abortions. First, in 1987 the Korean government revised the Medical Law to forbid premarital sex and sex-selective abortions. Secondly, efforts to eliminate gender inequality were strengthened; in 1989 the Korean government revised the Family Law for daughters so that they too would have the right to be household heads and receive an equal share of any inheritance (Cho and Lee 1999). The Medical Law was revised once again in 1994 to impose higher penalties for medical personnel who provided prenatal sex determination (up to 3 years of imprisonment, and up to a US \$12,500 fine in addition to the loss of the individual's professional license) (Choe et al. 2005). In response to the government's strong regulations, the frequency of sex selective abortions began to drop in the mid 1990s; the sex ratio at birth decreased from 115.2 in 1994 to 109.6 in 1999.

By 1990, the TFR of Korea was far below the replacement level. The negative consequences of this rapid fertility decline, including an unbalanced sex ratio of newborns, an increase in the elderly population, and a high prevalence of selective abortions, were also emerging (D. Kim and C. Kim 2004).

These new trends led to a debate regarding the direction of future population policies in Korea. Two groups argued about the direction of population policies. The first was comprised of those who supported the continuation of fertility control, arguing that the current level of low fertility was primarily due to the strong population control policies and that a change in policy would increase the fertility level. An increase would result in another era of rapid population growth, consequently slowing down economic growth and having adverse effects on the environment and resources (Choe et al. 2005). The second group supported a relaxation of fertility control policies, arguing that the socioeconomic conditions of South Korea have changed. These changes in attitudes and values toward a preference for smaller sized families and a further decline in fertility would result in rapid population aging and an increased burden of support for the elderly (Choe et al. 2005).

In the end, in 1996, “the Korean government officially announced the adoption of a ‘new population policy’ which focused on the quality of life and welfare of the Korean population” (I. K. Kim 2001: 4). The characteristics of this new family planning program marked a change from the quantitative control of the population to more qualitative considerations.

The major goals of the new population policy were 1) to maintain the TFR level of 1.7, 2) to improve the morbidity and life expectation levels of the population as part of the process of achieving sustainable socioeconomic development, 3) to enhance family health and welfare, 4) to prevent an imbalance of sex ratios at birth and to reduce the incidence of induced abortions, 5) to expand the scope of the family planning program's target population to cover the young unmarried population (in an effort to prevent premarital pregnancy), 6) to empower women by expanding employment opportunities and welfare services and 7) to improve work opportunities and provide adequate health care and welfare services for the elderly (Cho and Lee 1999). The one-child family norm was eliminated in the new family planning programs.

However, despite the government's moderate family planning efforts, the TFR of Korea continued to decline until it approached its current 1.0 level. Compared to the effects of the family planning programs conducted between 1960 and 1980, the new program has not played a significant role in fertility change, which has been stationary for the most part since the mid 1990s. On the other hand, socioeconomic conditions have tended to influence the decline in fertility. During the Asian economic downturn of the mid 1990s, both an unstable household economy and high unemployment, sustained by a national financial crisis, played decisive roles in delaying marriage and widening the birth interval. Thus, these non-demographic issues furthered the fertility decline in Korea.

In 2000, the TFR of South Korea was below 1.5, and by 2002 it had dropped to approximately 1.10. The TFR of 2004 and 2005 approached 1.16 and 1.08, respectively,

both of which indicate ‘lowest low fertility.’¹ In response to this lowest low fertility level, the Korean government declared in 2004 a policy shift to a pro-natal policy aimed at boosting the fertility rate (D. Kim 2005). This marked an important change in the 44-year history of Korean population policy. In 2004, the Korean government established a Population Policy Deliberation Committee in order to develop new pro-natal policy directions and measures for the future. Subsequently, in 2005 another new population policy was adopted with the goal of formulating comprehensive policies dealing with the consequences of low fertility and population aging, and of increasing the total fertility level to 1.6 by 2010 (Choe et al. 2005).

The Korean government has recently attempted to promote childbirth encouragement policies. However, the Korean pro-natal policies of 2004 and 2005 have not had much of an influence to date on fertility. “Fertility has continued to decline recently in Japan and several low fertility European countries in spite of their governments’ economic support for childcare, family-friendly workplace arrangements, and the provision of more flexible work opportunities for mothers” (D. Kim 2005: 19). Compared to these countries, the Korean government’s economic support is very limited. “The small amount of economic support for childcare and some family-friendly workplace arrangements for mothers are not likely to have a significant influence on young couples who have strong desires to maintain reasonable standards of living in a competitive society with high educational costs” (D. Kim 2005: 21).

¹ According to Billari (2004), the term ‘low fertility’ can be used when fertility is below the replacement level of 2.1. The term ‘very low fertility’ can be used when fertility is below a TFR of 1.5. And the term ‘lowest-low fertility’ can be used when fertility is below a TFR of 1.3.

In response to these problems, in 2006 the Korean government announced that \$19.3 billion would be invested by 2010 in efforts to boost the fertility rate. The new governmental plan includes expanding day care services and preschool education for infants, improving childcare facilities, providing full income payments to female employees on maternity leave, and financial support for sterile couples attempting to have babies through medical procedures.

As discussed earlier, family planning programs have not played a significant role recently in fertility changes in South Korea. Although the fertility decline in the past was due, in part, to the family planning program implemented in the country, the current decline does not seem to be responding to the current family planning program. Despite new family planning programs implemented in 2004, the TFR declined from 1.16 in 2004 to 1.08 in 2005. Therefore, in the research to be conducted in this thesis, family planning programs will be excluded in my analysis of county-level fertility. Rather, this research will focus on the socioeconomic effects on fertility differentials and the variation in low fertility among the various counties in South Korea in 2004.

According to 2004 vital statistics, the general fertility rate (GFR) of Korea was 34.72. It fluctuated spatially. The GFR among the provinces varied from a low of 26.32 in the Busan municipality to a high of 40.63 in Jeju Province. The GFR among the various counties varied from a low of 21.6 in Gangseo-gu to a high of 54.31 in Hwacheon-gun. Not surprisingly, even the upper values of the GFR for both the Korean provinces and the counties are considered to be extremely low.

Why does the fertility rate fluctuate and vary? What accounts for variance in the fertility rate? What factors (e.g., social, economic, political, cultural, or environmental effects) play a significant role in accounting for variation in fertility among the counties in South Korea? In this thesis, these questions will be addressed in an attempt to better understand the dynamics of fertility among the counties of South Korea in 2004.

Most previous Korean fertility studies have been conducted at the country or province level. Very little demographic analysis of fertility has been conducted at the level of the county. In 2004 the GFR for Yangpyeong county in Gyeonggi province was 32.24, whereas the GFR for Osan county in same province was 52.53. Even though both counties are in the same province, the question remains: why are their fertility rates so different?

In past research, socioeconomic factors and national family planning programs have been regarded as having the most effect on Korean fertility. Without a doubt, socioeconomic development (which has facilitated the successful implementation of national family planning) has been an important contributor to the decline in Korea's fertility (Cho and Lee 1999). Urbanization, along with rapid economic development, an increase in educational attainment for both males and females, and greater gender equality regarding educational and occupational opportunities tended to yield the lowest fertility. Thus, the general hypothesis of this thesis is based on demographic transition theory (DTT) that socioeconomic development is negatively associated with fertility.

Therefore, in this thesis several socioeconomic and related factors are hypothesized to be related to fertility among the counties in Korea. Variables such as

agricultural population, educational attainment, economic conditions, cultural norms, the status of women and gender equity in educational attainment are all expected to be significantly associated with the general fertility rate (GFR).

First, the percentage of agricultural population in each county is expected to be positively associated with fertility. In other words, the percentage of the population engaged in agriculture should be positively related to the GFR. It is well documented that the rapid process of urbanization throughout the country largely reduced the agricultural population—in 2004 the percentage of agricultural population in South Korea was measured to be only 7.1 percent of the whole population.

Other socioeconomic variables such as educational attainment and economic conditions are expected to be negatively related to the GFR. The improvement in education levels in Korea has been attributed to parents' zeal to provide to their children higher levels of schooling, which has been further facilitated by the rise in income and decline in number of children (Cho and Lee 1999). While the TFR decreased from 2.83 in 1980 to 1.47 in 1998, the advancement rate to college level or higher for high school graduates increased from 43.3 percent to 84.4 percent (Cho and Lee 1999).

Economic conditions should also have an important influence on fertility in Korea. During the Asian economic downturn in the mid 1990s, the unemployment rate was drastically high in Korea. Consequently, "the labor market's insecurity due to a remarkable increase in unemployment, layoffs, and part-time and temporary jobs played a decisive role in delaying marriage and widening the birth interval," (D. Kim 2005: 13) and thus has had a significant effect on fertility in Korea. Since the Korean national

economic crisis in 1997, the unemployment rate increased from 2.6 in 1997 to 7.0 in 1998, while the TFR decreased from 1.54 to 1.47. Although recovery from the economic recession has occurred since early 1999, the TFR of Korea has continued to decline.

In addition, gender equity in educational attainment and the increase of women in the labor force are expected to have negative associations with the GFR. In other words, the rise of both educational and labor force participation opportunities for women tends to result in lower fertility rates. The Korean economic crisis promoted two income marriages and female labor force participation in Korea. The rate of female labor force participation has increased from 47.1 in 1998 to 49.8 in 2004. Consequently, the increase in female labor force participation and the equal access to education for both males and females have both led to the rise of women's overall social status in Korean society.

Finally, the prevalence of traditional family norms and cultural values are expected to be related to fertility. The sex ratio at birth, the marriage rate, and the divorce rate are all anticipated to be related to the GFR, the first two in a positive direction, the third in a negative direction.

Socioeconomic development in Korea has promoted rapid urbanization and modernization, and as a result has had a huge impact on changes in traditional values and family norms. Since the mid 1990s, "Korean women's attitudes toward marriage and gender roles are changing rapidly" (Choe et al. 2004: 7). Currently, the notion of "marriage is optional, but a job is mandatory," is pervasive among many Korean young

women and explains the rapid decrease in the marriage rate in South Korea. The decrease in the TFR and the sex ratio at birth suggest that some fundamental changes in fertility behavior have been taking place. Several studies of attitudes toward marriage and family-building behaviors document that by the mid-1990s, traditional values such as the “oughtness” of marriage, parenthood, and having a son have considerably lessened (Bumpass and Choe 2004). Furthermore, it has been suggested that an increase in the divorce rate may be due to financial problems resulting from the economic crisis in 1997 (D. Kim and C. Kim 2004). But there has also been an increase in divorce among couples who have been married for a long time. These results indicate that the high rate of divorce was not only due to economic problems but to changes in traditional family norms in Korea.

The research to be conducted in this thesis could be very useful for investigating the nation’s current demographic conditions and for suggesting better future population policy options. According to 2004 vital statistics, South Korea’s county-level fertility rate fluctuated, although was extremely low. Considering the variance in fertility among the different counties could help researchers better understand the fundamental causes of the current low level of fertility in the country. In this context, this thesis will explore the variation in the GFR among the different counties within the nine provinces and seven municipalities, and will examine a mixture of sociological and demographic explanations.

Over the last few decades, the pattern of fertility decline in South Korea has changed. But there have to date been only a limited number of fertility analyses. This

this thesis expects to provide empirical findings about the effects of low fertility and fertility differentials across the country through an analysis of current county levels of fertility in South Korea in 2004. This study also expects to provide empirical findings which could lay the foundation for designing future pro-natal policies in Korea.

For its analysis, this thesis uses the latest vital statistics (collected in 2004) and 2000 census data. Although there are data limitations (since most Korean census data are based on province-level numbers and do not include specific indicators such as per capita income) the available statistics should provide useful data for the analysis of the current decline in Korean fertility.

The following chapter reviews the various socio-demographic explanations for fertility decline and the findings of previously conducted empirical studies of Korean fertility.

CHAPTER II

LITERATURE REVIEW

In this chapter, a detailed review of pertinent Korean fertility studies, spanning nearly two decades, will be presented. Although none of the studies was conducted at the county level, each investigated various socioeconomic effects on Korea's fertility decline. Before reviewing Korea's fertility studies, a brief account of the Demographic Transition Theory (DTT) will be provided as the main theoretical framework for this thesis. In this thesis, the DTT is expected to provide a reasonable standing of recent patterns of fertility decline in South Korea.

Demographic Transition Theory

Fertility decline from a high level to a low level occurred first in Western Europe between the middle of the 19th century and the middle of the 21st century. The DTT explains how populations change from high levels of fertility and mortality to low levels of fertility and mortality. These changes are heavily based on observed, historical changes in the West that link fertility and mortality changes to social, economic, and family changes caused by industrialization and urbanization (Notestein 1953). Given that it analyzes a substantial frame of time, the DTT argues that socioeconomic developments have been accompanied by notable fertility declines.

The earliest effort in the West to account for fertility declines was made by Warren Thompson (1929), Kingsley Davis (1945), and Frank Notestein (1945, 1953). Their research became the foundation of the theory of demographic transition (Hirschman 2005), which mainly assumes that socioeconomic developments lead to a

fertility decline. “The original accounts of this theory specified a variety of causal mechanisms, including the declining role of the family in economic organization, the independence of women from traditional roles, and the shift to rationality spurred by popular education” (Hirschman 2005: 393). An early iteration of the DTT, published by Warren Thompson in 1929, described a general historical theory of the relationship between population and economic growth which eventually became the basis for the subsequently developed theory of demographic transition (Szreter 1993). This earlier version of the DTT was maintained over the following decades and materialized in the 1940s as the Demographic Transition Theory (DTT)—chiefly due to the effort of Frank Notestein (Hirschman 1994; Notestein 1953).

Fundamentally, the DTT posits that socioeconomic development indicators such as industrialization, modernization, urbanization, and changes in social values and norms are all pre-conditions necessary for the fertility transition (Notestein 1953). In other words, both fertility rates and mortality rates, in response to an increase in socioeconomic development, are central to this theory. The timing of the studied fertility responses depends on the level of socioeconomic development and modernization.

According to Notestein (1953), fertility decline is attributed to changes in social life that are presumed to be caused by industrialization and urbanization (Mason 1997):

The new ideal of the small family arose typically in the urban industrial society. Urban life stripped the family of many functions in production, consumption, recreation, and education... The new mobility of young people and the anonymity of city life reduced the pressure toward traditional behavior exerted by the family and the community.... As a consequence, the cost of child-rearing grew and the possibilities for economic contributions by children declined.... Women,

moreover, found new independence from household obligations and new economic roles less compatible with childbearing (Notestein 1953: 13-31).

Kingsley Davis (1963) also asserted that “mortality reduction is the quintessential harbinger of the demographic transition” (Crenshaw et al. 2000: 1). When child mortality levels are improved, households tend to choose upward social mobility over having more children. He believed that “a fertility decline is triggered when one or more associated conditions reach certain threshold values” (D. Kim 2005: 5). To determine the threshold required for a particular fertility decline, Ansley Coale (1973) has pointed out that “there is more than one pre-condition for a decline in marital fertility: (1) fertility must be within the calculus of conscious choice, (2) reduced fertility must be perceived as (economically) advantageous, and (3) effective techniques of fertility reduction must be available” (Kirk 1996: 365).

While the DTT has been widely accepted as a generalized description of the evolution of the demographic process, “challenges to the historical and contemporary relevance and accuracy of [the] DTT have mounted” (Crenshaw et al. 2000: 371). Since the DTT has not performed that well in accounting for the timing of a particular fertility decline, Hirschman has noted that “over the past few decades intensive research on demographic change in historical and contemporary societies has revealed complex patterns that do not fit neatly into earlier theoretical schema” (Hirschman 1994: 204). This theoretical and methodological unfitness has taken its toll on the DTT, leading some demographers to conclude “...that [the] DTT is near death” (Hirschman 1994: 213).

According to Knodel and van de Walle (1979), the initial decline in fertility was not necessarily a response to prior changes in urbanization, education, agricultural detachment, or labor force participation: “(1) fertility declines took place under a wide variety of social, economic, and demographic conditions; (2) family limitation was not practiced among broad sections of the population of births—many have been unwanted; (3) increases in the practice of family planning and the decline of marital fertility were both essentially irreversible processes, once under way; and (4) a cultural setting influenced the onset and spread of fertility decline independent of socio-economic conditions” (p. 219). Consequently, many objections, qualifications, and doubts serve as modifications to, and extensions of, the DTT.

Lesthaeghe (1995; Lesthaeghe and Surkyn 1988) has extended the classic DTT “by adding to economic modernization a shift in values toward individualism and self-fulfillment that occurs with rising affluence and secularization” (Mason 1997: 444). He believes that fertility differentials are associated with cultural differences, religious beliefs, materialism and individualism (Lesthaeghe 1995). But since this addition to DTT is based on western European countries, it may not be applicable to the fertility transition in some Asian developing countries that still retain strong traditional values.

The Neoclassical Microeconomic Theory of fertility stresses that fertility behavior is determined by three determinants: income, the cost of children, and the preference for children, all of which are basic driving forces in fertility transition (Schultz 1973). Easterlin (Easterlin and Crimmins 1985) broadened the Microeconomic Fertility Model by combining economic and sociological theories of fertility decline.

His framework elaborates three determinants of fertility behavior: 1) the demand for children—the standard socio-economic determinants of fertility transition; 2) the supply of children—a cultural determinant that constrains natural fertility; and 3) the psychic, monetary, and time costs (Easterlin and Crimmins 1985). However, this microeconomic theory has little input with regards to the institutional determinants that trigger a fertility decline (Mason 1997). As Hirschman (1994) notes, the Microeconomic Theory of Fertility is too narrow to replace the DTT.

Caldwell (1982) restated the DTT by stressing the growth of the industrial system as one of the fundamental forces that leads to the dismantling of traditional familial norms and of low fertility. Unlike the classic DTT, he made an important distinction between ‘modernization’ and ‘westernization,’ but the primary force in fertility change appears to be westernization, which includes ideas of progress, secularization, mass education, and mastery over the environment (Kirk 1996). He argued that the predominance of the nuclear family in modern societies is attributed to westernization, making children a decisive economic burden, as well as the consequence of a reversal in the direction of “wealth flows” from children to parents in pre-modern societies. His restatement of the DTT, however, “does not clarify the nature of the specific appeal of westernized values and family systems” (Kirk 1996: 372). Also, Freedman (1979) and colleagues have noted that Caldwell’s theory does not account for the fertility decline in East Asian countries where fertility has decreased with little apparent change in regards to extended family relationships (Thornton and Fricke 1987; Mason 1997). For instance, the extended family system is still in place in some low-

fertility Asian countries, including South Korea, Taiwan, and China, indicating that the nuclear family (a western concept) is not a prerequisite for fertility decline.

Therefore, the mass of unsatisfactory restatements of the DTT force this thesis to rely upon an original formulation of the DTT. A number of empirical studies have criticized the DTT, but “the theory has ideas that are hard to ignore that live on” (Mason 1997: 444). Despite the fact that the broad scope of the DTT specified a variety of causal mechanisms for fertility decline, the original accounts of the theory still remain the basis for the most widely accepted theoretical framework. As Hirschman points out, “the portrayal of [the] DTT as a universal model of modernization and fertility decline is too general and vague, but there is a considerable body of evidence that socioeconomic development has been more influential in shaping historical and contemporary fertility declines than many critics have acknowledged” (Hirschman 2005: 394).

Many demographers argue that the characteristics of the demographic transition in some developing countries in East Asia are different from those of the transition that occurred in Western countries. Since many indicators were considered as predictors of the transition from high to low fertility, there were many potential hypotheses (depending upon the different regions). In the case of South Korea, fertility decline has long been assumed to be a consequence of socioeconomic development and successful governmental family planning programs. In this thesis, I expect to show that the DTT is plausible for use in accounting for variation in the fertility of the counties of South Korea. As mentioned earlier, while the new pro-natal policy (implemented in 2004) had had little effect on the state of Korea’s fertility, socioeconomic changes are still

considered to be significantly associated with Korea's recent low fertility and geographical fluctuations. I will now provide an overview of Korean fertility studies and their findings.

Korean Fertility Studies

Doo-Sub Kim (2005) has developed theoretical explanations of why and how Korea passed through the first fertility transition that occurred from 1960 to 1985, and the second fertility transition that occurred from 1985 to the present (D. Kim 2005). He observed that a satisfactory theoretical framework and structure of knowledge is needed, depending upon the different countries analyzed, in order to establish the general validity of the DTT (D. Kim 2005). Thus, he reformulated the original DTT in order to account for the recent fertility transition to lowest-low fertility levels in Korea. Basically, socioeconomic change represents one of the predominant conditions and underlying forces of fertility decline in the conceptual models he uses for his two fertility transitions (D. Kim 2005). Based on his mechanisms of understanding these fertility transitions, the first fertility transition can be explained as a function of five factors: socioeconomic change, industrialization, urbanization (e.g., internal migration), mortality decline, and family planning programs (D. Kim 2005). He has argued that "the first fertility transition was a joint product of socioeconomic change and the family planning programs" (D. Kim 2005: 20). In the early 1960s, high educational levels, the rise of income, female labor force participation, and all other developmental indicators, along with national family planning programs, all played an important reinforcing role in Korea's fertility decline.

However, the key concepts and the causal mechanisms of the second fertility transition are different from those of the first fertility transition in Korea. Unlike the conceptual model of the first fertility transition, government-organized family efforts, migration, and mortality decline were all no longer considered to be major determinants of the recent fertility decline in Korea (D. Kim 2005). Kim postulated that the “recent socioeconomic transformation and its accompanying changes in labor market, family formation, and gender equity orientation are the major underlying forces for the rapid decline of fertility” (D. Kim 2005: 11) in Korea since the mid 1980s. He emphasized that the expansion of the global economy always brings about socioeconomic changes through effects on economic restructuring, labor force participation, women’s status, value orientation, and other conditions that affect fertility (D. Kim 2005). More specifically, during the 1990s “globalization, characterized by free trade and free flows of capital and labor across international boundaries, resulted in labor market deregulation and increasing insecurity in the labor market” (D. Kim 2005: 13) in many Asian countries, including South Korea. Consequently, high unemployment rates and unstable economic conditions at both the household and the national levels all have had a tremendous impact on fertility decline in Korea. Accordingly, his underlying assumption of the DTT is applicable for both the first and second fertility transitions in South Korea.

Choe and associates (2004) examine several causes of Korea’s low fertility trend, using data from the 1990 and 2000 population censuses and the 1994 and 2000 rounds of the national fertility survey. These researchers then conducted cross-sectional studies

for the years 1994 and 2000, investigating the socioeconomic and demographic effects on marital fertility. Additionally, socioeconomic and demographic effects on marriage were also examined in cross-sectional studies for the years 1990 and 2000. These researchers hypothesized that socioeconomic variables to be important factors affecting both age at marriage and fertility. More specifically, education attainment and urbanization were expected to increase the age at marriage and decrease the marriage rates that promote fertility decline.

The results of this research showed that a demographic variable such as change in women's age structure (e.g., 20-24, 25-29, and 30-34) by itself does not explain the increase in proportion of being never married, among women aged 20-34 in the years 1999 and 2000. On the other hand, socioeconomic variables such as education and urban residence both have effects on the probability of never being married, among those women in the cross-section analysis. The researchers explained that an increase in education and residence in an urban area both should induce changes in values and norms with regards to marriage, indicating that a woman's age at marriage could rise more or less simultaneously in all socioeconomic groups (Choe et al. 2004).

Another finding shows that recorded changes in socioeconomic variables and demographic variables explain all of the changes in marital fertility among married women under age 40, throughout the 2.5-year reference period analyzed in the two survey years, 1994 and 2000. Although the socioeconomic variables did not appear to have longitudinal effects in the model, these variables are strongly associated with the age of a woman at marriage and her relative marital fertility. Accordingly, the results of

the analytical models indicate that socioeconomic predictors go a long way toward explaining cross-sectional variation in age at marriage and differences in marital fertility in South Korea, during the 1990s (Choe et al. 2004).

The authors put forth copious explanations for their findings. Socioeconomic changes brought about shifts in values, norms, and attitudes in Korean women about marriage and fertility during the 1990s (Choe et al. 2004). In particular, important socioeconomic changes during the 1990s such as the Asian economic crisis and rising female labor force participation, were argued to be responsible for the rapid rise in age at marriage and the rapid fall in fertility to very low levels (Choe et al. 2004). These researchers asserted that if Korea's TFR tended to decline in response to rapid growth of per capita income between 1985 and 1995, its decline after 1995 can be assumed to be affected by the Asian economic crisis and its aftermath. In addition, the rising female labor participation in non-farm occupations tended to reduce fertility between 1991 and 2000. This is primarily because the percentage of the female labor force's participation in non-farm occupations increased from 57 to 90 percent for always-married women aged 30-34, and from 26 to 37 percent for currently working women aged 30-34 (Choe et al. 2004).

Ik-Ki Kim (1987) investigated the socioeconomic determinants of fertility behavior among the three major groups of Korean married women: aged 30-34, 35-39, and 40-44, exploring both individual and community-level differences. Using data from the 1974 Korean National Fertility Survey, the model examined several socioeconomic effects such as married female respondent's education, childhood residence, working

experience before and after marriage, husband's education and occupation, and current residence, all with regards to fertility. These variables were also divided into two groups—individual-level (micro) variables and community-level variables. Community-level variables were comprised of two major categories—socioeconomic development and family planning variables. The analytical models used both micro and macro components; the micro component specified that the socioeconomic conditions affected the individual's fertility behavior, whereas the macro component specified that contextual characteristics affected the micro level relationship between socioeconomic indicators and fertility (I. K. Kim 1987). In these models, three fertility-related measures were examined as dependent variables: age at the birth of first child, early fertility (number of children born before the respondent reached the age of thirty), and later fertility (number of children born after the respondent's 30th birthday).

Kim carried out two different kinds of analyses: a preliminary analysis of fertility differentials in both urban areas (the transitional setting) and rural areas (the traditional setting), and a multilevel analysis of fertility behavior. In his first analysis, he hypothesized that: 1) the micro socioeconomic effects on age at first birth would be negative in rural areas and positive in urban areas; 2) women's education would be positively associated with early fertility regardless of the social context; and 3) micro-socioeconomic variables would be positively related to later fertility among two groups of older women, those aged 35-39 and 40-44, in less developed areas (I. K. Kim 1987).

However, Kim discovered that “the effects of women's education on age at first birth are positive and statistically significant for all women” (I. K. Kim 1987: 75). In

contrast to his hypothesis, women's education is negatively related to early fertility before the age of thirty in both urban and rural areas, but is only significant in the group aged 30-34 for both areas. This result suggests that younger women with a high education who live in both urban and rural areas all limit their family size, even before they reach the age of thirty. Also, the effects of micro-socioeconomic variables such as women's education, post-marital work experience, and husband's education on later fertility after the woman reaches the age of thirty are negative in both urban and rural areas—in particular, the effects of women's education and post-marital work experiences on later fertility are significantly negative among the two older age groups.

Unlike the preliminary analysis, macro-socioeconomic variables, along with the micro level socioeconomic variables, are included in this multilevel analysis. In the analysis of the woman's age at first birth, additive macro-socioeconomic development—the average level of education within a community and the micro-socioeconomic variable—yields a conclusion that a woman's education with regards to her age at first birth are positive and statistically significant, all through the hypothesized and analyzed age groups. This result also indicates that increases in the average level of education within a community would increase the woman's age at first birth (I. K. Kim 1987).

In the analysis of early fertility, a woman's pre-marital work experience was not only expected to be associated with the socioeconomic development variables but also the early fertility rate before the age of 30. The results of this researcher's analysis show that the average level of education of a community has a negative effect on fertility among the two groups of women aged 30-34 and 35-39, and they were also statistically

significant. This also indicates that an “increase in the average level of education in a community would decrease early fertility” (I. K. Kim 1987: 92). On the other hand, women’s education and pre-marital work experiences are negatively associated with early fertility. In addition, pre-marital work experience is positively related with socioeconomic development, as hypothesized.

Moreover, the hypothesized relationships between the micro- and macro-socioeconomic effects and family planning inputs, and later a woman’s fertility after age 30, were all tested. The results of these analytical models for later fertility show that: 1) the micro socioeconomic variables, such as women’s education, post-marital work experience, and husband’s education are negatively associated with fertility after the age of 30 among the two groups of women aged 35-39 and 40-44, and they were all statistically significant except the effects of women’s education on later fertility among the group of women aged 35-39; 2) the effect of a macro-socioeconomic variable such as the average level of education of a community and the number of general health facilities on later fertility is also negative and significant; and 3) the effect of the family planning program, such as the number of family planning workers on later fertility, is negative and not significant, but its effect is stronger among highly educated women.

Consequently, most of the above findings indicate that “socioeconomic development results in increased age at first birth and a reduced number of children” (I. K. Kim 1987: 110). For the most part, these findings support earlier studies that suggest that “socioeconomic development is accompanied by [a] desire [for a] smaller family

size, creating the conditions for fertility decline even in the absence of a national family planning program” (I. K. Kim 1987: 110).

Doo-Sub Kim (1987) has explored the relationship between fertility and indicators of socioeconomic status such as family income, occupation, urban residence, and the education of the wife and husband. The main objective of his study was to investigate the socioeconomic differentials in fertility in both Korea and the United States, focusing on the effects of socioeconomic inequality as well as the socioeconomic level of the community on fertility at the macro and micro levels. In a fertility analysis of Korea, he estimated various analytical models using the data sets from the Korean National Fertility Surveys and population censuses taken around 1975. In this review, I focus on the findings of his analytical models for the effects of socioeconomic indicators on Korea’s fertility (rather than the aspect of socioeconomic inequality).

Using data collected from 1,174 women in the 1974 Korean National Fertility Survey, Kim analyzed the socioeconomic differentials in fertility among the two groups of women aged 40-44 and 45-49. He focused on the group of women aged 40 who had almost finished childbearing at the time of the survey, in order to reduce the direct and indirect effects of a woman’s age as well as of the socioeconomic events of fertility (D. Kim 1987).

In previous empirical studies, “particularly in societies in the period of transition from high to low fertility, a more or less negative correlation of fertility to socioeconomic status has been found: the higher socioeconomic status groups having lower fertility” (D. Kim 1987: 6). Korea’s fertility has been found to be negatively

related to a woman's education, in both rural and urban areas and for all the time periods for which data were available (Cho et al. 1982). The women who have attained a higher educational level are more likely to innovate in fertility control which, consequently, results in lower fertility (Entwisle et al. 1982). In addition, women's work experience in non-farm related occupations has had a negative effect on fertility due to a role incompatibility, as well as due to greater exposure to more modern ideas and information about birth control. The effect of place of residence on fertility has also been widely examined in the study of fertility differentials and found to be negative in urban (more than rural) areas.

Kim's findings tend to support these early Korean fertility studies, showing that the macro- and micro-socioeconomic variables are negatively associated with fertility. The relationship between education and the number of children ever born is found to be most straightforward in his study. He has found a clearly negative relationship between individual education and fertility in the more urbanized areas, but less so in the less urbanized areas. He believes that younger women are likely to have a lower fertility because they tend to have received more education and marry at an older age (D. Kim 1987).

Another finding he observed was that women whose husbands are agricultural workers have markedly high fertility, whereas those whose husbands are professional, managerial and clerical workers have the lowest levels of fertility. Some pertinent studies have also found that "professionals and managers were distinctive for their high level of contraceptive use, while farmers and manual laborers were distinctive for their

low level of use” (Cho et al. 1982: 62). These findings indicate that “as Korea’s economy continues its industrial transformation and Korean men and women shift to jobs with higher occupational prestige, continuing fertility decline will be favored” (Cho et al. 1982: 62).

As one would expect, family income tends to be negatively related to fertility. Kim discovered that an expected family income and the index of family income are negatively associated with the number of children born. Moreover, expected family income is highly correlated with educational and occupational variables, indicating that those who expected a relatively high level of income have a higher educational level and more professional experience.

In addition, the effects of residence on the number of children born also appear to be influential in these models. Women in urban areas have fewer children than those in rural areas, suggesting that the fertility level is lower in urban areas than in rural areas. Interestingly, the effect of religion is also examined in his models, but was not found to be a significant factor. However, the results indicate that “Catholics show the highest fertility, and Protestants, the lowest” (D. Kim 1987: 91).

In sum, the age of women, as well as other socioeconomic covariates such as family income, the education level of the couple, and the husband’s occupation all turned out to be highly significant in explaining a variation in the number of children born (D. Kim 1987). Consequently, Kim’s findings appear to correspond with earlier studies showing that micro-socioeconomic variables are negatively associated with Korea’s fertility in the study.

Furthermore, Kim discovered that women in the community with higher levels of household income, educational attainment and occupational prestige are likely to have fewer children. In his macro-level analysis, the mean number of children of a community was found to be negatively associated with the socioeconomic status of that community. He also found that the socioeconomic inequality of the community has a positive effect on fertility, while the socioeconomic level of the community has a negative effect on fertility. He brought up the idea that the “socioeconomic structure of the community develops certain norms and values, which permit and prescribe individual decision making on fertility” (D. Kim 1987: 108).

Most of these findings are consistent with earlier studies. Consequently, fertility is affected not only by the socioeconomic status of individuals (at the micro-level) but also by the socioeconomic characteristics of the community (at the macro-level) in which they live.

In this chapter, the DTT and previous studies of Korean fertility have been reviewed. These theoretical and empirical studies have contributed to the understanding of the relationship between socioeconomic indicators and fertility. Building on these studies, this thesis will examine the relationship between socioeconomic predictors and fertility rates of the counties in South Korea. Also, the effects of other considerable factors, including the status of women and cultural norms on fertility will be examined in this research. The next chapter will describe the data and methodology to be used in the research.

CHAPTER III

DATA AND METHODS

Chapter III introduces the sources of data and discusses the analytical techniques to be employed in this thesis. Prior to elaborating on the data and methodology, the research hypotheses of this study will briefly be discussed. In addition, the operationalization of the independent and dependent variables specified in the hypotheses will be described in this chapter.

Hypotheses

As mentioned in the previous chapter, socioeconomic characteristics are expected to be negatively associated with fertility among the counties of Korea, and positively related to each other. In this analysis, three variables, namely, agricultural population, labor force participation, and educational attainment are used to measure the socioeconomic conditions of the Korean counties. The specific hypotheses for these three variables are as follows: among the 231 Korean counties, 1) the percentage of the population in agriculture should be positively related to fertility; 2) the labor force participation rate should be negatively related to fertility; and 3) educational attainment should be negatively related to fertility.

In recent studies, women's status has been considered to have an important effect on fertility, "since Korea has experienced substantial improvements in gender equity during the past two decades" (D. Kim 2005: 16). "Increasing trends in gender equity in education and market employment, and extended control over childbearing by women

are responsible for the fertility decline from low levels to very low levels during the past two decades in Korea” (D. Kim 2005: 17).

Thus, this thesis postulates that the status of women should be negatively associated with fertility. The specific hypotheses for the two female status variables are as follows: among the 231 Korean counties, 4) gender equity in educational attainment should be negatively related to fertility, and 5) female labor force participation should be negatively related to fertility. In other words, Korean women who have a higher educational attainment and more economic capability for self-support should tend to postpone or avoid having children (D. Kim 2005).

Recent findings also suggest that the changing traditional and cultural value orientations of families have resulted in an increasing incidence of divorce and a rise in the age at marriage for both men and women that, consequently, led to the fertility decline in Korea. Undoubtedly, “decreased family formation and increased family dissolution have been key factors of current fertility decline in Korea” (D. Kim 2005: 16).

During the 1990s, socioeconomic changes and the improved social status of women have contributed substantially to the decrease in the proportion of married couples and the increase in marriage dissolution. Since the nationwide economic crisis in 1997, it has been suggested that economic hardships trigger both a decrease in the marriage rate and an increase in the divorce rate. In particular, “the lack of stable jobs for young men has been an important reason for remaining single since the mid 1990s—decreasing confidence about their future employment prospects has kept young people

from their entry to marriage and reproduction” (D. Kim 2005: 15). At the same time, employment practices guaranteeing jobs until statutory retirement age have been disappearing, so many workers have had to quit working before reaching retirement age (D. Kim and C. Kim 2004). As a result of the unstable national economy and labor market insecurity, financial problems have often led to the divorce of couples with latent conflicts that accumulated over the course of their marriage (D. Kim and C. Kim 2004).

Accordingly, these trends toward delayed marriage and an increasing incidence of divorce have been brought about by a confluence of interrelated socioeconomic and cultural changes. These changes include educational attainment for women, a rapid increase in female labor force participation, major changes in the structure and function of the marriage market, an extraordinary increase in premarital sex, and far-reaching changes in marriage and traditional family values (Retherford et al. 2001).

In addition, a preference for male children has long been considered to have an effect on fertility behavior among Korean women. Under the Confucian system of the traditional patriarchal family, a male child was seen as crucial for carrying on the family name, for the rituals of ancestor worship, and for inheritance purposes in Korean society (Cho et al. 1982). On the other hand, the birth of a daughter was considered to be an unfortunate event, and women who could not bear a son could be expelled from the family. Nowadays, this traditional practice has disappeared, due to several factors such as socioeconomic changes, westernization, urbanization, and gender equity. Although a preference for male children has begun to lose the hold it had previously in Korean

society during the last two decades, “there is no doubt that the majority of Koreans maintain their traditional values on this subject” (Cho et al. 1982: 121).

However, several empirical studies have shown that son-selective reproduction behaviors raise the sex ratio at birth (SRB) and, at the same time, play a role in lowering the level of fertility in Korea, in contrast to an earlier proposition that stated that a strong preference for male children might provide a major obstacle to an attainment of low fertility (Park 1983; Arnold 1985). Nonetheless, in accordance with the fertility decline, the SRB is presently approaching its normal condition—it declined to 108.2 in 2004 from a peak of 116.5 in 1990.

While some demographers argue that son preference does not account much for the current low level of fertility, a preference for male children still plays an important role in determining the fertility behavior of Korean women. Particularly in Korea, rural residents or members of the older generations tend to have a strong preference for sons, as compared to their urban and younger counterparts. Koo (1979) has found that a preference for sons had a significant effect on fertility among the older urban residents, while any effect of preference for male children on the desire for more children in general was not found among young, low-parity women (Cho et al. 1982). Mostly, the effect of son preference on fertility is considered to be negligible among young Korean women. Doo-Sub Kim (2005) explains that “young couples are now less likely than the older generation to accept the ideology of patriarchy and traditional gender roles and, as a result, their attitudinal and behavioral expressions of the desired number of children and son preference are getting lower than ever” (D. Kim 2005: 17).

But since there has not been extensive research on the effects of son preference on current fertility levels in Korea, son preference (as a cultural norm indicator) will be examined as one of the independent variables in this research, representing overall traditional and cultural values.

Overall, traditional family norms and cultural values are hypothesized to be positively associated with fertility. More specifically, among the 231 Korean counties, 6) the marriage rate should be positively related to fertility; 7) the sex ratio at birth should be positively related to fertility; and 8) the divorce rate should be negatively related to fertility.

Operationalization

This thesis will analyze one dependent variable: the general fertility rate (GFR). The GFR represents the annual number of births in a given population per 1,000 women aged 15-49, and is calculated: $(\text{total number of live births to women} \div \text{the number of women aged 15-49}) \times 1000$. In this analysis, the GFR is used to measure Korean fertility, indicating a ratio of the number of live births per 1,000 women in the age group between 15 and 49, in each the 231 counties in South Korea in 2004.

Generally, three measures of fertility are used in most fertility studies: the crude birth rate (CBR), the general fertility rate (GFR), and the total fertility rate (TFR). Although the CBR is the most easily obtained, the GFR and TFR are more commonly used over the CBR, since they are more statistically refined. On the other hand, the GFR may not be comparable across time or place if one population has a high proportion of

women in the most fecund period because this measure does not account for age-related fertility fluctuations. In this case, the TFR is preferred over the GFR.

However, over the last decades, the average age at first marriage has increased for both men and women in South Korea. The trend toward delaying or avoiding marriage, as well as the increase in early divorces and re-marriage (especially among those aged 37-42) are, consequently, contributing to an increase in the mean age at first birth. Under these circumstances, I am confident that the GFR is a suitable measure of Korean fertility in this study.

In this analysis, eight independent variables are employed. All of these variables concern the 231 counties of South Korea in the years 2000 and 2004.

Three variables measure the level of socioeconomic development among the counties in Korea—the percentage of the population engaged in agriculture, the percentage of the population in the labor force above 15 years of age, and the percentage of the population aged 25 and over who attain above a university degree. As mentioned earlier, all socioeconomic predictors are expected to be negatively related to fertility. But these variables are positively associated with each other. For example, urban areas have higher levels of educational attainment and higher labor force participation rates than rural areas.

1) Agricultural population

The rapid process of urbanization has been one of the most significant socioeconomic effects on the fertility decline in Korea. The urbanization rate increased from 29 percent in 1960 to 81.9 percent in 2000, while the fertility rate has drastically

declined. Thus, in this thesis, the percentage of the agricultural population measures the degree of urbanization in each county. As mentioned in hypothesis, the percentage of the population engaged in agriculture tends to be positively related to fertility. Here is its operationalization: $(\text{the population that is employed in agricultural related work} \div \text{total population}) \times 100$.

2) Labor force participation

In accordance with the rapid economic development that has occurred since the early 1960s, the labor force participation rate has increased from 55.3 percent in 1960 to 62 percent in 1995. However, it decreased to 60.7 percent in 1998 due to a national financial crisis that yielded high unemployment rates, but it went up again to 62 percent in 2004 after the recovery from the economic recession. In sum, a steady increase in the labor force participation rate (economic development) has proceeded along with the fertility decline in Korea. Thus, the percentage of the population in the labor force (employed, self-employed or unemployed above 15 years of age) is anticipated to be negatively related to fertility. In other words, a higher percentage of the population in the labor force is linked to a lower fertility rate. This variable will be measured as follows: $(\text{the population in labor force} \div \text{total population (age 15+)}) \times 100$.

3) Educational attainment

Educational level, together with socioeconomic development has improved in Korea. “Since the early 1980s, the enrollment rate in elementary school has been almost 100 percent and the advancement rates from one level of school to a higher level has considerably increased” (Cho and Lee 1999: 29). According to the Korea National

Statistical Office (KNSO), the proportion of people aged 20 or over who have graduated from high school or higher, of the total population aged 20 or over, increased from 18.1 percent in 1970 to 63 percent in 1995 (Cho and Lee 1999). This substantial improvement in education has been considered to be one of the most significant effects on fertility in Korea. In this thesis, the percentage of the population aged 25 and over attaining above a university degree is usually employed, and therefore expected to be negatively associated with the GFR. It will be operationalized as: $(\text{the population attaining above university degree} \div \text{total population (age 25+)}) \times 100$.

Two variables will be used to measure the status of women in this thesis—gender equity in educational attainment, and female labor force population, both of which are expected to be negatively associated with fertility.

4) Gender equality in education

There has for a long time been a gap in educational attainment between women and men in Korea. “The average years of educational attainment in 1995 was 9.4 years for females and 11.2 years for males, a difference of 1.8 years between the sexes” (Cho and Lee 1999: 85). However, according to the KNSO, the female to male ratio for high school graduation or higher for ages 20 - 24 was 86.4 percent in 1985 and 101.4 percent in 1995, which marks a significant increase from 53.8 percent in 1970. On the other hand, “the female to male ratio for college graduation or higher for ages 25~29 was 38.9 percent in 1970, but increased to 55.5 percent in 1985 and 85.5 percent in 1995” (Cho and Lee 1999: 86). Although gender inequality in education attainment at the university level or higher still remains, during the past two decades there has been substantial

progress in reducing educational discrimination against Korean women. Consequently, gender equity in education improves women's social status, affecting Korean women's fertility. In this analysis, the ratio of the percentage of male educational attainment to the percentage of female educational attainment above a university degree measures a woman's status, which is anticipated to be negatively related to the GFR. Specifically, here is the ratio: the male education attainment above university degree (age 25+) ÷ the female education attainment above university degree (age 25+).

5) Female labor force participation

Gender discrimination in labor opportunities, as well as education, has declined. Consequently, this enhances Korean women's social status. Since 1960, an increase of women in the labor force has been considered to have a significant effect on fertility decline in Korea. The participation of women in the labor force gradually increased from 40.5 percent 1981 to 59.8 percent in 1998 for married women, while the TFR decreased from 2.66 to 1.47. In this thesis, the percentage of the female labor population aged 15 and over, a statistic used to measure women's social status, is anticipated to be related to the GFR, and will be measured as: (the female population in labor force ÷ total female population (age 15+)) × 100.

Regarding traditional family norms and cultural values, three variables will be used, namely, the sex ratio at birth, the marriage rate, and the divorce rate; they are expected to be associated with fertility. As detailed in the hypotheses, a gradual disappearance of traditional and cultural norms caused by rapid socioeconomic changes has had a tremendous impact on Korea's fertility.

6) Marriage

A continuous decrease in the rate of marriage has been observed during the past two decades in Korea. By 1980, the marriage rate began to decrease. It declined from a peak of 10.6 per 1,000 persons in 1980 to 7.0 in 2000. “With rapid changes in family values encompassing sexuality, marriage, children, divorce, and remarriage, young people are raising questions about the necessity of marriage” (D. Kim and C. Kim 2004: 151). Between 1990 and 2000 the proportion of single women aged 25-29 increased by 18.0 percent and the proportion of single women aged 30-34 increased by 5.4 percent (D. Kim and C. Kim 2004). In addition, both the age at first marriage and the age at first birth increased; the mean age at first marriage was 30.1 and 27.3 years, for men and women respectively, in 2003, which is an increase of 2.0 years for men and 2.2 years for women, from 1993 (D. Kim and C. Kim 2004); the mean age of women at first birth rose from 26.3 years in 1993 to 28.6 years in 2003 (D. Kim and C. Kim 2004). These changes in the culture of marriage corresponded to changes in fertility in Korea. In this analysis, the marriage rate per 1,000 Koreans over the age of 25 is expected to be positively related to the GFR. It will be operationalized as: $(\text{the number of marriage} \div \text{total population (age 25+)}) \times 1,000$.

7) Divorce

Since 1960, the level of divorce has rapidly increased in response to the fertility decline in Korea; the divorce rate remarkably increased from 0.3 per 1,000 persons in 1960 to 2.5 in 2000. The increase in the divorce rate continued and reached 3.5 in 2003; this is its highest level in modern Korean history. According to the KNSO, financial

problems have emerged as a major reason for the rapid increase in divorce in 2000. Financial problems as a self-reported reason for divorce accounted for 2.0 percent of the total divorces in 1990, but jumped to 10.7 percent in 2000 (D. Kim and C. Kim 2004). However, regardless of the economic crisis in 1997, “changes in family and marriage values have been taking place over a long period of time” (D. Kim and C. Kim 2004). Therefore in this thesis, the divorce rate per 1,000 Koreans over the age of 25 represents the opposite of traditional family norms and cultural values and is anticipated to be negatively related to the GFR. It is measured as follows: $(\text{the number of divorces} \div \text{total population (age 25+)}) \times 1,000$.

8) Son preference

“South Korea (along with China and Taiwan) has a Confucian patriarchal tradition where son preference is strong and pervasive” (Poston et al. 2003: 50). A strong preference for sons over daughters is a part of Korean culture that has maintained imbalances of the sex ratio at birth (SRB) in Korean society (Poston et al. 1997). One indicator of son preference is the reported SRB. A normal sex ratio at birth is around 105, meaning 105 boys are born for every 100 girls. However, the Korean SRB has been on the rise from 109 to 116 boys per 100 girls between 1985 and 2000, which is significantly above normal levels. After 2000, the Korean SRB dropped below 110, but was still higher than the normal value of 105. Interestingly, despite a rapid fertility decline during the past two decades, Korea maintained an abnormally high SRB. In terms of this imbalance in the SRB, “sex-selective abortion is believed to be a principal intervention leading to the higher than normal SRB” (Poston et al. 2003: 48). Due to

this technology, Korea's fertility has declined with its high SRB, but the deeply-rooted cultural influences of son preference still make it important for Korean women to make their own fertility decisions. In this analysis, the SRB measures a traditional and cultural norm which is expected to be positively related to fertility rates, and is represented as:
(the number of male live births ÷ the number of female live births) × 100.

Data

The principal data source for this thesis is the Korean Statistical Information System (KOSIS), which is a program of the Korea National Statistical Office (KNSO). KOSIS is an online statistical database that provides a wide range of domestic and international statistical data in long-term series delineated by month, quarter, and year. Most data for this thesis are derived from 2004 Korean vital statistics and the 2000 Population and Housing Census of Korea, both of which are available through KOSIS. All these data are taken from the Korean vital and civil registration systems, and are provided for each province, municipality, and county. This analysis uses county-level data to measure the dependent variable and independent variables.

Korean vital statistics collected in 2004 provide detailed vital statistics on births, deaths, marriages and divorces, including the resident registration population by sex and five-year age groups, the number of children born categorized by sex and the number of marriages and divorces for all 256 counties. The data for the dependent variable, i.e., the general fertility rate (GFR), and the three independent variables such as the sex ratio at birth, the marriage rate, and the divorce rate used in this analysis are all derived from the 2004 Korean vital statistics.

Vital statistics in modern form were first compiled in Korea in 1910. However, early vital statistics were not reliable until the 1980s due to a delayed registration of vital events, problems associated with the general use of the lunar calendar, and the inconvenience of obtaining certificates of cause of death from a medical doctor (Cho et al. 1982). As the vital registration system gradually improved over the two decades between 1960 and 1980, “delayed registration of births and deaths became much less frequent, and the general public became more cooperative” (Cho et al. 1982: 25).

While Korea’s vital statistics have data limitations, the KNSO, in recent years, has developed other types of demographic statistics such as methods for censuses and survey data. Consequently, “there are now more than enough data to make analysis of fertility and family planning behavior possible” (Cho et al. 1982: 31). Since most Korean censuses are not available at the county level, this is another data limitation. Thus, I will use data from an additional census, the 2000 Population and Housing Census of Korea.

As in many other countries, the Korean population censuses were conducted based on four basic principles, namely, individual enumeration, universality within a defined territory, simultaneity, and defined periodicity (D. Kim and C. Kim 2004). Generally, the Korean population census “defines an individual household as a survey unit and enumerates the characteristics of each individual in the household within the territory of Korea, with a given time reference (November 1) of every five years” (D. Kim and C. Kim 2004: 34).

Census 2000 was the latest census conducted by the KNSO. This census covered 50 items, 29 of which addressed population-related information and 21 of which addressed household and housing-related information. While the basic items such as name, sex, age, relationship to the head of household, marital status, and educational attainment were asked for all households, questions other than basic items were asked only of 10 percent of the sampled households (D. Kim and C. Kim 2004). For example, in the 2000 census the items of total labor force participation, as well as female labor force participation, were surveyed for only 10 percent of the sampled households.

Labor force population has been measured in several ways in the Korean census. Generally, the usual approach has been to measure the status of economic activity by asking about activities over a longer duration of, for example, one year. However, Census 2000 used 'the labor force approach' for its economic activity survey, measuring the status of economic activity by asking about activity during a relatively shorter period of one week or one day (D. Kim and C. Kim 2004). The economic activity survey in the 2000 census included items on economic activity status, seeking jobs for the reference period, and whether or not job seekers were currently available for work (D. Kim and C. Kim, 2004).

Census 2000 includes useful data for several independent variables for this thesis, namely, the percentage of the population in the total labor force, as well as the female labor population, the percentage of the population in agriculture, and the population by age, sex, and educational attainment. Census 2000 contains various reliable data, but

data for 25 counties are not available for the above variables. Thus, I will restrict my analysis in this thesis to 231 counties.

All data used in this thesis are collected by the “si,” “gun,” and “gu” county units of seven municipalities and nine provinces in South Korea. Although Korean population statistics and censuses include a wide range of data, most of them do not have information available at the county level. For instance, age-specific birth rates are not available at the county level, whereas they are available at both the province and country levels through KOSIS. Due to this data limitation, in this thesis I will use the general fertility rate as a measure of the average number of children in each county.

As mentioned earlier, socioeconomic predictors are expected to have important effects on the fertility decline in Korea. Given this hypothesis, income levels would be important socioeconomic indicators. However, unfortunately, income data have not been available in most Korean censuses. In the 1990 census, a household income question was included for the first time in the questionnaire, but the income data collected were not published due to inaccuracies in their representation (D. Kim and C. Kim 2004). In addition, women’s income and occupation (e.g., occupational prestige) can be measures of women’s status, which has a significant impact on fertility. But due to data unavailability, this thesis instead measures female labor force participation and gender equity in educational attainment between males and females to determine the status of women.

Methods

In this thesis I will estimate a series of Ordinary Least Squares (OLS) multiple regression models. Before conducting the OLS analyses, several diagnostics steps will be taken in order to ensure statistical accuracy in the models. Firstly, I will attend to the normality assumption by evaluating the distribution of dependent and independent variables. All the variables in the regression equation do not have to be normally distributed, but skewed Y and/or X distributions of the result in non-normal error distributions that produce some form of bias in the results (Hamilton 1992). If the skewness exceeds 0.8 in absolute value, the distribution is considered to be skewed and needs to be modified. Also, comparing the mean and median values for each variable indicates whether or not the distribution of the variable is skewed. If the value of the mean is higher than that of the median, then the distribution is skewed right. To the contrary, if the median has a higher value than the mean, then the distribution is skewed left. Thus, if any variable is found to be greatly skewed, it will be modified by using power transformations that make the variable distributions more symmetrical. As Hamilton notes, “skew can often be reduced, and outliers pulled in, by power transformations” (Hamilton 1992: 17). Secondly, many independent variables will likely be correlated with each other, leading to problems of multicollinearity. When multicollinearity becomes extreme, serious estimation problems occur; the parameter estimates become unreliable. In order to check for the existence of multicollinearity among variables, I will estimate the zero-order correlation of the independent variables with the dependent variables, and with each other. Additionally, scatterplots of each

bivariate relationship will be examined to see the visual representation of the positive and negative correlations among these variables. These scatterplots are basic tools for understanding the relationship between two measurement variables, and several examinations for heteroscedasticity, multi-collinearity, and curvilinearity can be observed.

After estimating the OLS regression models, I will use another diagnostic method. I will examine the tolerance values of the independent variables in the regression model, in order to determine if the multi-collinearity is too extreme. If the tolerance value for any independent variable is under 0.35, the regression equation should be modified. Furthermore, if many of the independent variables are collinear with each other, I will consider splitting my analysis into several OLS models.

Additionally, I will also apply two diagnostic methods such as “Model Diagnostics” and “Effect Diagnostics.” DFITS (a combination of leverage score and studentized residuals) and DFBETAs will both be employed to determine if the regression model and the regression effects are being unduly influenced by certain observations.

Finally, I will test the validity of the OLS results by using a Robust Regression. “The prevalence and broad consequences of outliers make them a major problem for OLS and related methods” (Hamilton 1992: 189). Robust methods provide alternatives to OLS for dealing with nonnormal errors, heteroscedasticity, and curvilinearity (Hamilton 1992). If the OLS and the robust methods have consistent estimations, then I will rely more directly on the OLS results. On the other hand, if there are any

discrepancies between OLS and robust estimates of the regression coefficients and standard errors, I will depend more heavily on the robust regression results.

In sum, Chapter III describes the data source and statistical methods, including the research hypotheses and the operationalization of nine variables used in this thesis. In the analysis, this thesis expects to find that counties with a lower percentage of the population in agriculture, a higher percentage of total population in labor force, a higher percentage of the population aged 25 and over attaining above a university degree, a higher percentage of the female labor population, a lower ratio of the percentage of male educational attainment to the percentage of female educational attainment above a university degree, a lower marriage rate, a higher divorce rate, and a lower sex ratio at birth have lower fertility rates.

The following chapter will provide a detailed description of the dependent and independent variables.

CHAPTER IV

DESCRIPTION

Chapter IV is a description of the dependent variable and eight independent variables to be employed in the analytical models, providing a foundation for the hypotheses to be tested in this thesis. Specifically, it will provide data on the mean, standard deviation, range, and minimum and maximum values for each variable. Each variable will then be discussed. According to descriptive data on each variable, specific counties (the units of analysis) will be identified and discussed geographically, culturally, and socio-economically.

South Korea is subdivided into the seven independent municipalities of Seoul (the capital city of Korea), Pusan, Daegu, Inchon, Kwangju, Daejon, and Ulsan, and the nine provinces of Kyunggi-do, Kangwon-do, Chungchongbuk-do, Chungchongnam-do, Chollabuk-do, Chollanam-do, Kyongsangbuk-do, Kyongsangnam-do, and Cheju-do, for a total of sixteen separate and geographically exclusive subdivisions. These major subdivisions are shown in the map (see **FIGURE 3**). Given that most of the independent municipalities contain a population number equivalent to that of the provinces, in this thesis seven municipalities are considered to be province equivalents.

As mentioned in the previous chapter, the 2004 Korean vital statistics list contains detailed vital statistics for all 256 county equivalents, i.e., the “si,” “gun,” and “gu” units. But since the 2000 census, which is also used in this analysis, does not provide data for 25 of the counties included in the 2004 vital statistics, 231 Korean

county equivalents of the seven municipalities and nine provinces will be the units of analysis used in this thesis.

Dependent Variable

The dependent variable is the general fertility rate (GFR). The GFR is the number of live births per 1,000 women aged 15-49 years. According to 2004 Korean vital statistics, South Korea's GFR is 34.72, which is equivalent to a TFR level of 1.04. The GFR among the provinces and municipalities of Korea ranges from a low of 26.32 in the Pusan municipality to a high of 40.63 in Cheju-do province. This GFR range is equivalent to a TFR range of .79 to 1.22. However, there is slightly more variability among the counties than in the provinces; the mean GFR among the 231 counties is 34.36 (SD 6.50), ranging from a low of 21.6 in Gangseo-gu (in the Pusan municipality) to a high of 54.31 in Hwacheon-gun (in the Kangwon-do province) (see **TABLE 1**). This GFR range is equivalent to a TFR range of .6 to 1.62. Not surprisingly, both provinces and counties vary in their GFR, but the high GFR values are very low. This indicates that by and large, Korea's fertility rate is extremely low all across the country.

The six counties with the lowest GFRs are all located in the Pusan municipality—namely, Seo-gu, Dong-gu, Yeongdo-gu, Dongnae-gu, Geumjeong-gu, and Gangseo-gu counties. These GFRs are equal to TFRs less than 1.0. The Pusan municipality, which houses 16 counties, contains the third largest population after the Seoul municipality and the Kyunggi-do province, and is one of the most socioeconomically and culturally developed areas in South Korea. Additionally, Gangnam-gu county (in the Seoul municipality), where the consumer price index for

living necessities is the highest in Korea, also has the lowest GFR. Given that most of the seven municipalities are urbanized and advanced in the way of socioeconomic development, more than even the provinces, it is not surprising that most counties with the lowest GFRs are found in these municipalities. This also supports the negative relationship between socioeconomic development and fertility, based on demographic transition theory as discussed in previous chapters.

The eight counties with the highest GFRs are found in four provinces: Hwacheon-gun, Yanggu-gun, and Inje-gun counties (in Kangwon-do province), Hwasun-gun and Yeongam-gun counties (in Chollanam-do province), Chilgok-gun county (in Kyongsangbuk-do province), and Jinhae-si and Geoje-si counties (in Kyongsangnam-do province). Kangwon-do province is mostly a mountainous or rural area which, comparatively, has the smallest population in Korea. In addition, Chollanam-do, Kyongsangbuk-do, and Kyongsangnam-do provinces have the highest agricultural populations in the country.

Independent Variables

Three independent variables indicate the socioeconomic conditions of the counties of Korea. Firstly, the percentage of the total population engaged in agriculture-related work has a mean value of 21.31 (SD 20.49) among the counties of Korea (see **TABLE 1**), with a low of 0.0 in 25 counties in the three municipalities of Seoul, Pusan, and Incheon, and a high of 67.1 in Sinangun, a county in Chollanam-do province. This indicates that among the 231 counties, only 21.26 percent of the total population is employed in agriculture-related work. As expected, most municipalities (which are

considered to be urbanized and economically developed) have the lowest percentage of agricultural population. In the case of the Seoul municipality, 18 of the 25 counties have 0.0 percent agricultural population, indicating that, overall, less than one percent of the population in Seoul is employed in agriculture-related work. As mentioned before, the Seoul municipality is the capital of Korea and, as such, the center of government, economy, and culture. The per capita GDP of Seoul is much higher than that any of the other provinces and municipalities in Korea. Dong-gu, a county in the Incheon municipality, also has a 0.0 percent level of agricultural population. The Incheon municipality is located in the suburbs of the Seoul municipality, and also has, relatively, the highest GDP size. By and large, only 8.8 percent of the total population in the Incheon municipality is engaged in agriculture-related work. Moreover, six counties such as Jung-gu, Dong-gu, Yeongdo-gu, Busanjin-gu, Nam-gu, and Suyeong-gu counties in the Pusan municipality have 0.0 percent agricultural population. As shown before, these six counties (in the Pusan municipality) are the counties with the lowest GFRs, which are less than a TFR level of 1.0. This also supports the hypothesis of this thesis that the percentage of the population employed in agricultural related work is negatively related to fertility.

The seven counties with the highest percentage of agricultural population are located in two provinces, Chollabuk-do and Chollanam-do. These two provinces contain a large proportion of the total agricultural area, as well as a large number of farming households. Chollabuk-do province houses four counties all with the highest agricultural population: Jinan-gun, Jangsu-gun, Imsil-gun, and the Sunchang-gun.

Chollanam-do province houses three counties: Damyang-gun, Hampyeong-gun, and the Sinan-gun. Unlike the seven municipalities, the nine provinces all report annual farm household income, indicating that the provinces overwhelmingly contain a higher percentage of the population engaged in agriculture-related work over that of the municipalities.

The second socioeconomic indicator is the percentage of total population in the labor force, which has a mean value of 57.39 (SD 6.71). This indicates that among the counties of Korea, 57.39 percent of the total population is engaged in the labor force or are seeking a job. The variability of the percentage of labor force participation ranges from a low of 43.4 in Dong-gu, a county in the Kwangju municipality, to a high of 77.7 in Sinan-gun, a county in Chollanam-do province. Interestingly, in contrast to the supposition that the labor force participation rate should be higher in the municipalities than in the provinces, the nine counties with the lowest percentage of the population in the labor force are all located in four municipalities: Seo-gu, Yeongdo-gu, Dongnae-gu, and Suyeong-gu counties (in the Pusan municipality), Jung-gu and Suseong-gu counties (in the Daegu municipality), Dong-gu, Nam-gu, and Buk-gu counties (in the Kwangju municipality), and Dong-gu county (in the Daejeon municipality).

On the other hand, the ten counties with the highest percentage of their population in the labor force are all located in four provinces: Jangsu-gun and Sunchang-gun counties (in the Chollabuk-do province), Goheung-gun, Haenam-gun, Jindo-gun, and Sinan-gun counties (in the Chollanam-do province), Gunwi-gun, Uiseong-gun, and Seongju-gun counties (in the Kyongsangbuk-do province), and Namjeju-gun county (in

the Cheju-do province). These ten counties with the highest percentage of labor force participation also contain a high percentage of agricultural population. Given that three of the provinces, Chollabuk-do, Chollanam-do, and the Kyongsangbuk-do, but not Cheju-do (which has a much larger area of cultivated land than the seven municipalities), cover the largest areas of cultivated land in Korea, labor force participation in these ten counties is assumed to be mainly concentrated in agriculture. Since Korean agricultural industries are concentrated in these provinces, four provinces have a high total income stemming from agriculture. On the contrary, non-agricultural industries such as those in service and finance tend to centralize in the municipalities. Consequently, the unemployment rates in the municipalities are higher than those in the provinces, indicating that there is likely a more intensive level of job competitiveness (mostly for white collar jobs) in municipalities than in provinces. This circumstance best explains why the counties with a lofty percentage of agricultural population also have a high percentage of labor force participation.

The last socioeconomic variable is the percentage of the population with above a university degree. The mean value for total educational attainment is 10.63 (SD 7.00), which means that, on average, 10.63 percent of the population in the Korean counties aged 25 and over have at least a university degree. The range of educational attainment fluctuates from a low of 1.96 percent in Sinan-gun, a county in the Chollanam-do province, to a high of 42.24 in Gangnam-gu, a county in the Seoul municipality. As expected, the Seoul municipality has the highest percentage of its population attaining above a university degree. In particular, Gangnam-gu and Seocho-gu counties (in Seoul)

have become known as a special education zone for the whole country, since many young parents with high incomes and a passion for education concentrate in these counties which, in turn, leads to an overflow of educational product. Furthermore, these two counties display one of the lowest fertility rates among the counties of Korea, which highly supports the theoretical statements presented earlier in this thesis. On the contrary, Sinan-gun county (in the Chollanam-do province) with the highest agricultural population and labor force participation in agriculture-related works has the lowest percentage of educational attainment above a university degree.

The other counties with lofty percentages of educational attainment are mostly located in the Seoul municipality and Kyunggi-do province. Namely, Dongjak-gu county, where most educational institutes and preparatory schools are concentrated, and Secho-gu, Gangnam-gu, and Songpa-gu counties, which are socially, culturally, and economically advanced areas, have a high percentage of educational attainment. All of these counties belong to the Seoul municipality. Additionally, Gwacheon-si, Goyang-si, and Seongnam-si counties, which are all located in Kyunggi-do province, also display a high percentage of educational attainment. Particularly, these three counties are new suburban areas developed for the express purpose of alleviating the concentration of population in the Seoul municipality. Counties with the highest percentage of educational attainment have a small population engaged in agriculture, which lends support to the theoretical expectation that high-levels of educational attainment should characterize urban areas more so than in rural areas.

Without doubt, counties with a low level of educational attainment are concentrated in the provinces. Five counties such as Goheung-gun, Boseong-gun, Hampyeong-gun, Jindo-gun, and the Sinan-gun, located in Chollanam-do province, account for only 2 to 3 percent of the total population with above a university degree. In addition, Jangsu-gun and Imsil-gun counties in the Chollabuk-do province and Yeongdeok-gun and Seongju-gun counties in the Kyongsangbuk-do province also have a low percentage of education attainment above a university degree. All of these counties together contain 50 to 70 percent of the total population engaged in agriculture and have a high percentage of labor force participation in agriculture, suggesting that levels of educational attainment are lower in rural areas than in urban areas.

The next two independent variables are gender equity in educational attainment and female labor force participation; both represent women's social status. The ratio of the percentage of male educational attainment to the percentage of female educational attainment above a university degree measures gender equity in education, which has a mean value of 2.09 (SD 0.48). This indicates that among the various counties in Korea, on average men obtain above the level of a university degree two times more often than women. A value of 1.0 would indicate that men and women have an equal level of educational attainment above a university degree. The value is greater than 1.0, men attain above a university degree more often than women. Conversely, a value of less than 1.0 would mean that women attain above a university degree more often than the men. As anticipated, men obtain a university degree or higher more often than women.

Among the various counties of Korea, the sex ratio of educational attainment ranges from a low of 1.34 in Seocho-gu, a county in the Seoul municipality, to a high of 5.0 in Hampyeong-gun, a county in the Chollanam-do province. There is no single county with a value of less than 1.0, clearly indicating that men, on average, have higher levels of educational attainment in all counties than do women in Korea. As has been shown above, Seocho-gu county was established to be one of the counties with the highest percentage of its total population attaining above a university degree, while Hampyeong-gun county was one of the counties with the lowest percentage of educational attainment. Among the high educational attainment counties, the sex ratio of educational attainment over and above a university degree approaches a value of 1.0, indicating that gender inequality in education tends to be less in such areas.

Most counties in the seven municipalities and the Kyunggi-do province have a lower sex ratio of educational attainment than those of the other eight provinces. In particular, the lowest values mostly occur in the Seoul municipality and Kyunggi-do province. The ten counties, including Seocho-gu, Gangnam-gu, and Songpa-gu counties in the Seoul municipality have the lowest values of gender inequality in education. On the other hand, all of the provinces except Kyunggi-do province have a high value, a level greater than 2.0. Chollanam-do province has the highest degree of gender inequality in education in the country, denoting that men's education attainment is between 3 and 5 times higher than women's. The counties with a high degree of gender inequality in educational attainment above the university degree, are in counties in Chollanam-do province, namely, Goheung-gun, Gangjin-gun, Haenam-gun,

Hampyeong-gun, and Sinan-gun counties. These also show a lofty percentage of agricultural population and a low percentage of total population attainment above a university degree. Educational attainment seems to be more equalized for men and women in urban cities than in rural areas.

The variable percentage of female labor force participation has a mean value of 43.99 (SD 9.6), which means that among the counties of Korea, almost 44 percent of the female population is employed in the labor force. The percentage of female labor force participation ranges from a low of 29.3 in Gyeryong-si, a county in Chungchongnam-do province, to a high of 71.1 in Sinan-gun, a county in Chollanam-do province. Although Gyeryong-si county, which has the lowest percentage of the female population in the labor force, belongs to Chungchongnam-do province, the other 10 counties with the lowest percentage of female labor force participation are all located in five municipalities (Pusan, Dae-gu, Kwangju, Daejon, and Ulsan). As shown before, the counties with the lowest percentage of labor force participation are all situated in the municipalities. These counties also tend to have the lowest percentage of female labor force participation. On the other hand, the counties with the highest percentage of labor force participation are all located in the provinces, which tend to have the highest percentage of female labor force participation. In 2004, unemployment rates were higher in seven municipalities and the Kyunggi-do province than in the other eight provinces. Kyunggi-do province and the Seoul municipality each contain a population of 10 million people, which make them the largest population centers in Korea. Even though the Seoul municipality is situated in Kyunggi-do province, both have an

equivalent GDP size, which is also the largest in the country. Unlike the other eight provinces, the province of Kyunggi-do has a low percentage of agricultural population, indicating that it is more urbanized and industrialized than the other provinces. However, since the national financial crisis in 1997, many industries and businesses have been hit hard by the recession. In particular, white collar jobs were significantly reduced which, consequently, raised unemployment rates in the seven municipalities and in Kyunggi-do province where the percentage of the agricultural population was extremely low. For instance, in 2004, unemployment rates for women were more than double those of the other eight provinces. Accordingly, economic hardship appears to have a more significant impact on the job market in urban areas than in rural areas.

The next three variables, the sex ratio at birth (SRB), the divorce rate, and the marriage rate, all reflect the presence of traditional family norms and cultural values. The mean value for the SRB is 109.70 (SD 9.76), meaning that among the counties, almost 110 boys are born for every 100 girls. This mean value is clearly higher than the biologically normal level of 105. Among the 231 counties in 2004 that were surveyed, the SRB ranged from a low of 68.42 in Yeongyang-gun, a county in the Kyongsangbuk-do province, to a high of 156.25 in Seongju-gun, a county in the Kyongsangbuk-do province. Only 23 counties have SRBs of less than 100; most of the counties report SRBs greater than the normal level of 105.

The counties with the highest SRBs are mostly found in the provinces (particularly, Chollanam-do and Kyongsangbuk-do) and show values greater than 128. Among the municipalities and provinces, the Dae-gu and Ulsan municipalities, and

Chollanam-do, Kyongsangbuk-do, Kyongsangnam-do, and Jeju-do provinces, all have SRBs of greater than 110. Except for two municipalities (Dae-gu and Ulsan), most of the municipalities maintain a value of between 106 and 107, which is close to a normal level. On the other hand, most provinces (except Kyunggi-do and Chollabuk-do) maintain a value of between 109 and 110. Over all, the counties with the loftiest agricultural populations tend to have higher SRB values, and these counties are mostly found in the provinces. This shows that the SRB tends to be higher in rural areas than in urban areas.

A second traditional family norms variable is the marriage rate, which shows a mean value of 8.22 (SD 1.9). This indicates that among the counties, on average, there are 8.22 marriages per 1,000 persons in the segment of the population aged 25 and over. The range for the marriage rate varies from a low of 4.23 percent in Yeongyang-gun, a county in Kyongsangbuk-do province, to a high of 12.46 percent in Gwanak-gu, a county in the Seoul municipality. It was not expected by the theoretical reasoning of this thesis that counties with a lofty marriage rate would be located in big cities such as the Seoul and Pusan municipalities, and counties with the lowest marriage rate would be located in the eight provinces (except Kyunggi-do province) with the highest level of agricultural population. Furthermore, most counties with the highest marriage rate have a higher population percentage in the labor force, as well as women who are working. Given this situation, these statistics may be explained by the age distribution of the population of each region. Since there is a strong tendency for young people to move to a city, agricultural areas will tend to contain a large number of the older and oldest

people in the population. In fact, the aged-child ratio (persons 65+ divided by persons 0 to 14) of five provinces (Kangwon-do, Chungchongnam-do, Chollabuk-do, Chollanam-do, and Kyongsangbuk-do) is higher than that of the municipalities. Among farm households, the proportion of people aged 50 and over is much higher in those provinces that have the highest total annual income from agriculture than in the municipalities. As a result, most municipalities (which contain a large proportion of young people) tend, relatively, to have a greater marriage rate than do the provinces.

The last independent variable is the divorce rate, which has a mean value of 3.89 (SD 0.98). This indicates that, on average, there are 3.89 divorces per 1,000 persons in the population aged 25 and over, among the various counties in Korea. The divorce rate ranges from a low of 1.56 in Sunchang-gun, a county in Chollabuk-do province, to a high of 7.12 in Dongducheon-si, a county in Gyeonggi-do province. Sunchang-gun county, as well as three more counties with low divorce rate, Jangsu-gun, Imsil-gun, and Gochang-gun, are all situated in Chollabuk-do province. All of these counties have a large agricultural population, indicating that traditional family norms are still more strongly embedded in the rural areas than in the urban areas. Also, additional five counties with the lowest divorce rate, Ulseong-gun, Cheongsong-gun, Yeongyang-gun, Cheongdo-gun, and Bonghwa-gun, are all situated in Kyongsangbuk-do province.

The ten counties with the highest divorce rate are all located in Incheon municipality and in Gyeonggi-do province. Six counties (Jung-gu, Dong-gu, Nam-gu, Namdong-gu, Bupyeong-gu, and Seo-gu) from the total of ten counties housed in the Incheon municipality, and four counties (Dongducheon-si, Ansan-si, Siheung-si, and

Yangju-si) housed in Gyeonggi-do province all maintain a 6 percent level of the population divorcing, which is the highest level recorded in all the Korean counties. As mentioned before, the Incheon and Seoul municipalities are situated in Gyeonggi-do, and all three areas are the most urbanized and developed in the country. Consequently, traditional norms are likely to be weaker in the urban areas. As expected, the divorce rate is much higher in the municipalities than in the provinces.

Transformed Variables

After conducting statistical tests for normality, two independent variables, percentage of total population in the labor force and sex ratio of educational attainment above a university degree, were found to be skewed. As mentioned in a previous chapter, skewed variables often result in skewed error distributions, producing some form of bias in the analysis. Thus, in order to avoid this problem, these two variables are in need of transformation.

As shown in **TABLE 2**, the educational attainment variable has a skewness value of 1.6, which is greater than the accepted level of 0.8. Given that the mean value is greater than the median, this is positively skewed. However, after using a log transformation, the skewness of percentage educational attainment dropped from 1.6 to 0.11, making its distribution near normal. The mean value of the log of percentage educational attainment is 2.17 percent (SD 0.62), varying from a minimum value of 0.67 percent to a maximum value of 3.74.

The skewness value of the educational attainment sex ratio was greater than 0.8 at 1.67, so this also needed to be transformed. The positive skew of this sex ratio

variable was reduced by using the log transformation; its skewness statistic dropped from 1.67 to 0.69. The mean of the log of sex ratio of percentage educational attainment is 0.72 (SD 0.21), ranging from a minimum value of 0.29 to a maximum value of 1.61.

The independent variable, Sex Ratio at Birth (SRB) also has a positive skew of 0.89 but this could not be satisfactorily transformed. Because its skewness value only slightly exceeds a value of 0.8, the skewness of the SRB is not deemed to be a major problem.

In summary, this chapter has presented descriptive data on the independent and dependent variables for Korea's counties. This has served to suggest how fertility varies among Korea's regions depending on socioeconomic factors and women's status and cultural values. The next chapter will present the results of the analytical models estimated and will interpret the results.

CHAPTER V

RESULTS

This chapter presents the results of several OLS (Ordinary Least Square) regression models estimating the general fertility rate among the counties of South Korea. These regression analyses will show whether or not the research hypotheses of this thesis, based on demographic transition theory (DTT), are confirmed. Before examining the results of the regression models, I briefly discuss the diagnostic tests that helped in not only reducing both bias and statistical errors, but which also improved the models used in this analysis. Afterwards, I will elaborate on the results of eight multiple regression analyses of the general fertility rates among the 231 counties of Korea in 2004.

Diagnostic Analyses

In order to ensure the statistical accuracy of the regression analysis, prior to the analysis I employed several diagnostics. First, I examined the distributions of the variables to determine whether the X and Y variable distributions were normal. As discussed in the previous chapter, two independent variables, the percentage of educational attainment and the sex ratio of the percentage of educational attainment, were both found to be skewed (the value of skewness was greater than 0.8) and were therefore modified by a log transformation. As Hamilton (1992) notes, non-normal error distribution often results from heavily skewed Y and/or X distributions which, consequently, reduces the accuracy of the analysis.

In addition, I also expected that many of the independent variables would be intercorrelated, leading to problems with multicollinearity. As mentioned earlier, this would make the estimation less precise and, eventually, unreliable because it would produce large variances for the estimation of parameters, resulting in larger than acceptable standard errors. Therefore, I first appraised the zero-order correlations of the independent variables with the dependent variable of the GFR, examining the bivariate correlations among the eight independent variables (see **TABLE 3**). As expected, all the independent variables are associated with the GFR, but three associations are opposite to the direction of the theoretical hypothesis of this thesis; namely, that the divorce rate is positively associated with the GFR, the percentage of the total labor force participation is positively associated with the GFR, and the percentage of the agricultural population is negatively associated with the GFR.

However, given that the percentage of the agricultural population ($r = -0.0004$), the percentage of educational attainment ($r = -0.012$), and the percentage female labor force participation ($r = -0.002$) have low zero-order correlations with the GFR, these correlations would be not significant.

According to **TABLE 3**, all three socioeconomic variables are weakly associated with the GFR: the percentage of total labor force participation is measured at 0.147, the percentage of the agricultural population at -0.0004, and the percentage of total educational attainment at -0.012. This is not consistent with the theoretical anticipation because this thesis expects that socioeconomic predictors should be significantly associated with Korea's fertility rate. However, given that the agricultural population

has a negative relationship to the GFR, this suggests that the fertility rate would be low even in rural areas, regardless of urbanization. As has been reported in the descriptive data, the labor force participation tended to be higher in those counties with a higher agricultural population, so the positive relationship between the percentage of labor force participation and the GFR would be taken for granted here. Despite the wrong direction, the percentage of total labor force participation has the highest correlation with the GFR among the three socioeconomic variables. Additionally, scatterplots visually show the association of the GFR with each of the eight independent variables, indicating their positive or negative correlation (see **FIGURES 4-11**).

Most independent variables are highly collinear with each other, which indicates that there is a problem of multicollinearity. In particular, all socioeconomic variables—the percentage of the agricultural population, the percentage of total educational attainment, and the percentage of total labor force participation—all have a high correlation with each other or with the female status variables (the percentage of female labor force participation and the sex ratio of educational attainment) above 0.6: the percentage of agricultural population and the percentage of total educational attainment are correlated at -0.868, the percentage of the agricultural population and the percentage of total labor force participation at 0.855, the percentage of the total labor force participation and the percentage of total educational attainment at -0.796, the percentage of total educational attainment and the percentage of female labor force participation at -0.818, the percentage of total educational attainment and the sex ratio of educational attainment at -0.763, the percentage of total labor force participation and the percentage

of female labor force participation at 0.948, the percentage of total labor force participation and the sex ratio of educational attainment at 0.711, the percentage of the agricultural population and the percentage of the female labor force participation at 0.907, and finally the percentage of the agricultural population and the sex ratio of educational attainment at 0.778. Additionally, two female status variables also have a high correlation of 0.717.

In addition, one of the traditional norms and cultural values variables, the marriage rate, is highly collinear with all the other variables, i.e., the divorce rate (0.651), the percentage of total educational attainment (0.651), the percentage of the agricultural population (-0.736), the percentage of female labor force participation (-0.633), and the sex ratio of educational attainment (-0.602), except the percentage of total labor force participation. Another cultural value variable, the divorce rate, is also highly collinear with the percentage of the agricultural population (-0.698) and the percentage of the female labor force's participation (-0.637). Consequently, most of the independent variables are collinear with each other, which could produce serious problems in the regression analysis.

Therefore, I divided my analysis into eight multiple OLS regressions to eliminate these problems with multicollinearity. After assessing the estimated OLS regression models, I examined for each equation the “variance inflation factor (VIF)” — the reciprocal of the tolerance ($1/\text{tolerance}$) for the independent variables in the regression equation—to determine whether or not there was a problematic degree of multicollinearity. The zero-order correlations already indicated a high degree of

multicollinearity in the estimated regression models. Thus, each model is completed by employing tolerance. If the tolerance values of any independent variable in the equation are under 0.35, then its variable is not used.

Accordingly, all socioeconomic variables are highly collinear with each other and with the female status variables, so they cannot exist together in one regression equation. In other words, if any socioeconomic variable is involved with another socioeconomic variable or female status variable, some problematic variables must be eliminated from the equation. Consequently, all eight variables cannot be together in a single regression model, but rather, they must be differently contained in several divided models. Nonetheless, fortunately, two socioeconomic variables, the percentage of total educational attainment and the percentage of total labor force participation, have no problem with multicollinearity with regard to one female status variable and all of the traditional norms and cultural values variables. Thus, only two regression models can contain all of the three different characteristic variables.

TABLE 4 shows the effects of independent variables on the GFR for two multiple regression models, each of which contains one socioeconomic and one female status variable and all the cultural values variables. The standardized regression coefficients are listed in parentheses under each coefficient in the models, and the significance of each coefficient is marked with an asterisk, depending on its significance levels.

Now I will elaborate on a detailed interpretation of the regression coefficients and the statistical measures in each analytical model.

Models 1-2

Model 1 examines the effects of five independent variables predicting the general fertility rate, including the percentage of total labor force participation, the sex ratio of the percentage of educational attainment, the divorce rate, the marriage rate, and the sex ratio at birth. In the equation for Model 1, the percentage of total labor force participation represents socioeconomic development and is expected to be negatively associated with the GFR; the sex ratio of the percentage of educational attainment reflexes women's status and is expected to be positively associated with the GFR; and the divorce rate, the marriage rate, and the sex ratio at birth all represent traditional norms and cultural values and are expected to be positively associated with the GFR (except the divorce rate).

However, the results from Model 1 do not fully support of the above-listed hypotheses. The results are as follows: 1) percentage of the total labor force participation is positively associated with the GFR; 2) the sex ratio of the percentage of educational attainment is positively related to the GFR; 3) the divorce rate is positively associated with the GFR; 4) the marriage rate is positively related to the GFR; and 5) the sex ratio at birth has a positive association with the GFR.

In contrast to the DTT hypothesis, the percentage of the total labor force participation is found to be positively related to the GFR, and statistically significant at $p < 0.005$. The divorce rate is also not consistent with the hypothesis, and was found to be positively related to the GFR but not statistically significant. This was an unexpected

result because the number of divorces has rapidly increased, along with the decline in fertility, during past decades in Korea.

As hypothesized, the sex ratio of the percentage educational attainment is positively associated with the GFR, and statistically significant at $p < 0.005$. A higher sex ratio of the percentage of educational attainment, representing a higher inequality in educational attainment for women, should be associated with a higher GFR. In addition, the marriage rate is also found to be positively related to the GFR, and statistically significant at $p < 0.005$. The sex ratio at birth is positively associated with the GFR but not statistically significant.

In Model 1, an adjustment to the value of R^2 is 0.524, meaning that all five independent variables explain almost 52 percent of the variation in the GFR; the F statistic is 69.81 with $p = 0.000$, indicating that the null hypothesis that all the regression coefficients in the population are zero can be rejected. To compare the size and magnitude of the coefficients in the model, standardized regression coefficients have been calculated to measure the relative weights attached to the explanatory variables in contributing to the mean of the dependent variable. In Model 1, the marriage rate ($b^* = 0.896$) has the strongest effect on the GFR, followed by the sex ratio of the percentage of educational attainment ($b^* = 0.421$), the percentage of labor force participation ($b^* = 0.312$), the divorce rate ($b^* = 0.019$), and the sex ratio at birth ($b^* = 0.006$).

In sum, the sex ratio of percentage of educational attainment is significant effect on fertility, as shown in Model 1. However, given that the percentage of labor force

participation has a positive relationship with the GFR, this result does not support demographic transition theory.

Model 2 uses four of the same independent variables as Model 1: the sex ratio of the percentage of educational attainment (a female status variable), the divorce rate, the marriage rate, and the sex ratio at birth (all cultural value variables). But Model 2 uses a different socioeconomic variable: the percentage of educational attainment. Unlike Model 1, all coefficients in Model 2 are associated with the GFR in the direction hypothesized.

Consistent with my expectations, the percentage of total educational attainment is negatively related to the GFR, and statistically significant at $p < 0.005$. In other words, as the percentage of the population who attain above a university degree increases, the GFR decreases, controlling for the effects of the other independent variables. The sex ratio of the percentage of educational attainment also has a positive association with the GFR and is statistically significant at $p < 0.005$, as was the case in Model 1. As might be expected, the marriage rate is positively related to the GFR, and this association is significant at $p < 0.005$. The sex ratio at birth is also found to be positively related to the GFR, but not statistically significant. However, contrary to Model 1, the association between the divorce rate and the GFR is negative in Model 2, which is the same direction as that hypothesized. But this association is not significant.

In Model 2, the marriage rate ($b^* = 1.010$) has the strongest effect on the GFR, followed by the sex ratio of the percentage of educational attainment ($b^* = 0.433$), the percentage of educational attainment ($b^* = -0.295$), the divorce rate ($b^* = -0.089$), and

the sex ratio at birth ($b^* = 0.022$). The R^2 (adj.) is 0.514, meaning that the predictor variables together explain almost 51% of the variation in the GFR. Although the R^2 (adj.) is slightly greater in Model 1 than Model 2, both have five coefficients, which together explain over 50% of the variation in the GFR. In addition, the F statistic is 49.56 with $p = 0.000$, demonstrating that the null hypothesis that all X variables in the model equal zero must be rejected.

In sum, the percentage of educational attainment, the sex ratio of the percentage of educational attainment, and the marriage rate all have a significant effect on fertility, as shown in Model 2. Importantly, the educational attainment predictor has a negative relationship with the GFR, in accordance with the DTT hypothesis.

Robust regressions were also estimated for Models 1 and 2. The results show no serious difference between the coefficients and standard errors in the OLS and robust models. Both the OLS and the robust results of Models 1 and 2 also produce about the same value for R^2 (adj.). Given that the coefficients are nearly the same in the robust and OLS models, this thesis will rely on the OLS models results.

Overall, the results of Models 1 and 2 show that the percentage of total educational attainment, the sex ratio of the percentage of educational attainment, and the marriage rate all have a significant effect on the GFR in the direction hypothesized. However, the percentage of total labor force participation is found to be significantly associated with the GFR, but this association is positive (which is opposite to that posited by the hypothesis).

Models 3-5

Models 3-5 (see **TABLE 5**) estimate multiple OLS regression coefficients for the GFR with regards to both socioeconomic and cultural values variables. In the three models, two women's status variables, namely, such as the percentage of labor force participation and the sex ratio of the percentage of educational attainment, were eliminated due to the strong multicollinearity problem between them and the other independent variables. In these models, we expected to find that all socioeconomic variables should be negatively related to the GFR, based on the DTT hypotheses.

Model 3 examines four effects on the GFR of the percentage of the agricultural population, the divorce rate, the marriage rate, and the sex ratio at birth. As expected, the percentage of the agricultural population, which measures socioeconomic development, was found to be positively related to the GFR and statistically significant at $p < 0.005$. In other words, for every increase in the percentage of the population involved in agriculture, there is a corresponding decrease in the GFR. In the results, three traditional norm and cultural value variables are associated with the GFR in the direction hypothesized, except for the divorce rate; 1) the marriage rate has a positive association with the GFR, and is statistically significant at $p < 0.005$; 2) the sex ratio at birth is also positively related to the GFR, but not statistically significant; and 3) the divorce rate is positively associated with the GFR but in the opposite direction to that which was hypothesized, and statistically significant at $p < 0.005$.

Considering the relative effects (i.e. the standardized effects) of the four independent variables on fertility, the marriage rate ($b^* = 1.025$) has the strongest effect

on the GFR among the independent variables, even though its association with the GFR is opposite to the hypothesized direction. It is followed by the percentage of the population in agriculture ($b^* = 0.877$), the divorce rate ($b^* = 0.188$), and sex ratio at birth ($b^* = 0.036$). The R^2 (adj.) is 0.545, indicating that the independent variables used in this model account for almost 55% of the variation in the GFR. This is slightly higher than the R^2 (adj.) values in Models 1 and 2. The F-test also shows that the null hypothesis which states that all X variables in the model equal zero should be rejected, as $F = 69.81$ and $p = 0.000$.

Model 4 also uses all three traditional norms and cultural values variables, but only one different socioeconomic variable: the percentage of educational attainment. In Model 4, the percentage of educational attainment is negatively related to the GFR and statistically significant at $p < 0.005$. As hypothesized, the marriage rate has a positive association with the GFR, and is statistically significant at $p < 0.005$. The sex ratio at birth is also positively associated with the GFR but is not statistically significant. However, contrary to Model 3, the divorce rate was found in Model 4 to be negatively related to the GFR, and statistically significant at $p < 0.05$. The results are the same, even when the female status variable, the sex ratio of the percentage of educational attainment, is added to Model 4, as it was in Model 2.

Compared to Model 2, the partial regression coefficients in Model 4 are larger, except the marriage rate. In particular, the effect of the percentage of educational attainment on the GFR is found to be significant in both models. The partial slope of this socioeconomic variable increased from -3.088 in Model 2 to -5.947 in Model 4, and

the value of the standardized coefficient (b^*) also increased from -0.295 to -0.568. However, the marriage rate ($b^* = 0.962$) has the strongest effect on fertility in Model 4, followed by the percentage of educational attainment ($b^* = -0.568$), the divorce rates ($b^* = -0.136$), and the sex ratio at birth ($b^* = 0.049$). The R^2 (adj.) value is 0.442, a drop from 0.514 in Model 2. The null hypothesis that all X variables in this model equal zero is rejected, as $F = 46.48$ and $p = 0.000$.

Model 5 examines the effects of the same three cultural values variables and one different socioeconomic variable, the percentage of labor force participation, on the GFR. In this model, only two coefficients, namely, the percentage of labor force participation and the marriage rate, are significant at $p < 0.005$. However, the percentage of labor force participation and the divorce rate are found to be positively related to the GFR, which is contrary to the hypothesis developed earlier in this thesis. These results are also shown to be exactly the same as those in Model 1. Model 5 has all the same coefficients that were used in Model 1, except for the sex ratio of the percentage of educational attainment. Consistently, the marriage rate and the sex ratio at birth are, in Model 5, positively related to the GFR.

The partial regression coefficients in Model 5 are larger than in Model 1, except for the marriage rate; compared to Model 1, the percentage of labor force participation increased from 0.302 to 0.531; the divorce rate increased from 0.126 to 0.369; the sex ratio at birth increased from 0.004 to 0.016; but the marriage rate decreased from 3.070 to 2.542. In Model 5, the marriage rate has the strongest relative effect on the GFR, as $b^* = 0.742$. The R^2 (adj.) is 0.452, a decreased from 0.514 in Model 1, meaning that all

explanatory variables together in the model explain almost 45% of the variation in the GFR. The F-test shows that the null hypothesis that all X variables equal zero must be rejected, as $F = 48.49$ and $p = 0.000$.

The estimated robust results assure the validity of these three OLS regression models, showing that there is no serious difference or change between the coefficients and the standard errors.

Accordingly, the results of Models 3 thru 5 confirm that socioeconomic predictors are significantly associated with fertility, in keeping with the DTT, but the percentage of total labor force participation is related to the GFR in the wrong direction, as shown in Model 5. In addition, the divorce rate is found to be positively associated with the GFR in Models 3 and 5, but this association is only significant in Model 3.

Models 6-8

Models 6-8 (see **TABLE 6**) estimate the effects of women's status and traditional norms and cultural value variables on the GFR. Unlike previous models, socioeconomic variables are not analyzed in these models. Rather, two women's status variables, i.e., the percentage of female labor force participation and the sex ratio of the percentage of educational attainment, and three traditional norms and cultural values variables, are employed in Models 6-8. I expect to find that women's status should be negatively related to the GFR.

In Model 6, four coefficients for the sex ratio of the percentage of educational attainment, the divorce rate, the marriage rate, and the sex ratio at birth on the GFR, are examined. The sex ratio of the percentage of educational attainment measures gender

inequality in educational attainment above a university degree, representing a woman's status. As expected, the sex ratio of the percentage of educational attainment is positively related to the GFR, the divorce rate is negatively related to the GFR, the marriage rate is positively associated with the GFR, and the sex ratio at birth is positively associated with the GFR. However, only the sex ratio of the percentage of educational attainment and the marriage rate are significant at $p < 0.005$, in this model.

Model 6 has all the same coefficients as Model 1, except for the percentage of labor force participation. Compared to Model 1, the partial slopes for all coefficients increased in Model 6; in particular, the coefficient of the sex ratio of the percentage of educational attainment significantly increased from 13.059 to 18.741; the divorce rate increased from 0.126 to 0.481; the marriage rate increased from 3.070 to 3.124; and the sex ratio at birth increased from 0.004 to 0.020. But the R^2 (adj.) value decreased slightly from 0.524 in Model 1 to 0.484 in Model 6.

Model 7 uses another women's status variable, the percentage of female labor force participation, along with all three traditional norms and cultural values variables: the divorce rate, the marriage rate, and the sex ratio at birth. In this model, the percentage of the female labor force participation is expected to be negatively related to the GFR, the marriage rate and the sex ratio at birth are expected to be positively associated with the GFR, and the divorce rate is expected to be negatively related with the GFR.

The results show that the percentage of female labor force participation and the divorce rate are associated with the GFR, but in the wrong direction. In Model 7, the

percentage of female labor force participation and the marriage rate are significant at $p < 0.005$. Given that the percentage of labor force participation was found to be positively related to the GFR in Models 1 and 5, this result might be not surprising. The divorce rate is also positively related to the GFR, which is opposite to the hypothesis of this thesis. This result was also found in the previous models. However, in Model 7 the marriage rate ($b^* = 0.801$) had the largest relative impact on the GFR, followed by the percentage of female labor force participation ($b^* = 0.537$), the divorce rate ($b^* = 0.065$), and the sex ratio at birth ($b^* = 0.043$).

Compared to Model 6, the partial regression coefficients of traditional norms and cultural values variables are reduced in Model 7; the divorce rate decreased from 0.481 to 0.428; and the marriage rate decreased from 3.124 to 2.742; but the sex ratio at birth slightly increased from 0.020 to 0.028. The R^2 (adj.) is 0.401 in Model 7, which is a decrease from 0.484 in Model 6. The F-test shows that the null hypothesis that all the coefficients are zero in the model must be rejected, as $F = 39.56$ and $P = 0.000$.

Model 8 uses all the variables in Models 6 and 7 to predict the GFR. Once again, the percentage of female labor force participation is significantly and positively associated with the GFR, the sex ratio of the percentage educational attainment is significantly and positively related to the GFR, and the marriage rate is significantly and positively associated with the GFR. All these coefficients are significant at $p < 0.005$. As shown in Model 7, the divorce rate is also positively related to the GFR, and not statistically significant in Model 8. The sex ratio at birth is found to be positively associated with the GFR, but is not statistically significant.

In Model 8, the marriage rate ($b^* = 0.942$) has the strongest relative impact on the GFR, as was the case in Model 7, followed by the sex ratio of the percentage educational attainment ($b^* = 0.485$), the percentage of female labor force participation (0.250), the sex ratio at birth ($b^* = 0.015$), and the divorce rate ($b^* = 0.010$). However, compared to Models 6 and 7, the partial regression coefficients of the two women's status variables decreased in Model 8; the sex ratio of the percentage of educational attainment decreased from 18.741 in Model 6 to 15.032 in Model 8, and the percentage of female labor force participation decreased from 0.363 in Model 7 to 0.169 in Model 8. Among the traditional norms and cultural values variables, the coefficient of the divorce rate decreased from 0.481 in Model 6 and 0.428 in Model 7 to 0.069 in Model 8. The R^2 (adj.) is 0.51, meaning that all coefficients in Model 8 account for 51 percent of the variation in the GFR.

Robust regressions were estimated, and their results compared with the OLS results for Models 6-8. There were no discrepancies between the OLS and robust estimates of the regression coefficients and the R^2 (adj.). This suggests that the OLS results for Models 6-8 are trustworthy.

The women's status variables in Models 6-8 are all significantly associated with the GFR. The results show that the percentage of female labor force participation is related to the GFR in the wrong direction, but the sex ratio of the percentage of educational attainment is positively related to the GFR, in accordance with the hypothesis of this thesis. However, the results of Models 6-8 are not consistent in terms of the divorce rate; in Model 6, the divorce rate is negatively related to the GFR, but it is

positively associated with the GFR in Models 7 and 8. But the coefficient of the divorce rate is not statistically significant in all the models. On the other hand, the marriage rate is significantly and positively associated with the GFR. The sex ratio at birth is positively related to the GFR in all models but not statistically significant.

In this chapter, the results of several OLS multiple regression models predicting the GFR among the 231 counties of Korea in 2004 are presented. We have focused primarily on the socioeconomic effects on the GFR, in order to test the DTT hypotheses. Also, the effects of women's social status and traditional norms and cultural values on the GFR are introduced and examined. As discussed earlier, due to multicollinearity problems among the X variables, the analysis was split into different eight regression analyses.

Over all, the results generally support the DTT, revealing that two socioeconomic variables are significantly associated with the GFR in the direction hypothesized. In Models 2 and 4, the percentage of educational attainment is found to be significantly and negatively related to the GFR. In Model 3, the coefficient of the percentage of the population involved in agriculture has a positive association with the GFR, and is statistically significant. On the other hand, in Models 1 and 5, the percentage of labor force participation is found to be significantly associated with the GFR but in the wrong direction.

In five regression models, the coefficients for women's status were all found to be significantly related to the GFR. In four models, the coefficient of the sex ratio of the percentage of educational attainment had a positive association with the GFR. However,

the results of Models 7-8 show that the percentage of female labor force participation is positively related to the GFR, which is opposite to the hypothesis of this thesis.

Three effects of traditional norms and cultural values on the GFR are examined in the all regression models. In each model, the coefficient of the marriage rate is significantly and positively related to the GFR; the sex ratio at birth has a positive association with the GFR, but is not statistically significant. However, the coefficient of the divorce rate is significant only in Models 3-4, and signed in the hypothesized direction in three models (2, 4 and 5).

The next chapter will interpret the OLS results of the hypothesis tests and discuss some of the implications of the analyses conducted in this thesis.

CHAPTER VI

CONCLUSIONS AND DISCUSSION

In this thesis, my primary objective was to examine the effects of socioeconomic development on the fertility rates of the 231 counties of South Korea in 2004. As shown earlier, Korea's fertility rate not only fluctuates spatially but is also extremely low all over the country. Given that only a few studies have investigated the variation in the current low levels of fertility among Korea's counties, this thesis fills an important void. Most of my hypotheses are based on demographic transition theory, which posits that socioeconomic developments lead to fertility decline, and most were supported. This last chapter will elucidate on an implication of this study and discuss the results of the analyses conducted. Additionally, future work in this area of research will be suggested for further study.

Since 1960, South Korea has been going through a rapid demographic transition in mortality and fertility. Previous studies have suggested that socioeconomic development and government-led family planning programs play important roles in causing these rapid transitions. Since the early 1960s, under President Park's administration, South Korea achieved a miraculous level of economic development, along with a significant reduction in fertility and mortality. The conviction that a growing population obstructs economic development promoted the national family planning program instituted in 1962 as one strategy for economic prosperity. Consequently, national family planning programs were effectively implemented to

reduce fertility below replacement levels of 2.1, under the successive five-year economic development plans.

During the 1970s, these family planning programs were designed mostly to promote high rates of contraceptive use and to encourage a norm of small families. In particular, a 2-child family norm was facilitated with the famous slogan “regardless of sons or daughters, stop at two and raise them well.” As a result of these government efforts, the total fertility rate (TFR) of Korea decreased from 6.0 in 1960 to the below-replacement level fertility rate achieved in the mid 1980s. However, even after achieving this desired replacement level of fertility, a 1-child family norm was continued through the slogan “Even two children for a family is too many for an over-crowded Korea.”

Since the mid 1980s, this small family norm, as well as a heavy preference for male children owing to Confucian ideology, produced an abnormally high sex ratio at birth (SRB) in Korea. It was strongly believed that human interventions such as prenatal sex identification and sex-selective abortion operated to disturb the biologically normal SRB. In the early 1980s, the Korean SRB began to increase, and then finally reached a level of 117 in 1990, which is significantly above the normal level of 105. In response to the unbalanced sex ratio of newborns, Korea’s population policies began addressing this problem, causing premarital sex and sex-selective abortions to be forbidden by new medical laws. Due to these new regulations, the SRB dropped to below 110 in the mid 1990s, but still maintained above normal levels.

During the 1990s, the TFR of Korea was at a level of near 1.4, far below replacement. The rapid decrease in fertility and mortality caused new problems, such as an increase in the size of the older and oldest-old populations. This new emerging problem made the Korean government reconsider the direction of future population policies. Thus in 1996, a new population policy was adapted which is more concerned with the quality of the population than the quantitative control of the population. Despite moderate population policies and the government's effort to maintain the replacement level of fertility, the TFR of South Korea kept declining to near 1.10. In 2004, the TFR reached approximately 1.16, which was the lowest fertility rate of any country in the world. This trend of 'lowest-low fertility' has become the bottom line in bringing on a population policy shift towards a pro-natal policy in Korea.

Given the situation, Korea's fertility transition seems to no longer be a response to the government's population policies. Undoubtedly, Korean family planning programs have been very effective in population reduction through the last 40 years and through successive socioeconomic development, but since 2000, this has shifted to pro-natal policies in an attempt to promote childbirth. Despite the government's program of childbirth encouragement in 2004, in 2005 the TFR declined to 1.08.

Despite the absence of any effective family planning policy on fertility after 2000, the degree of socioeconomic development is still deemed to have a significant effect on Korea's fertility decline. In addition, women's social status, which has been improved by socioeconomic development and/or the disappearance of traditional norms based on Confucianism, is also suggested to be an important factor in fertility decline. Thus, this

thesis did not consider the effect of family planning programs in its analysis of Korea's fertility in 2004. Rather, the findings of the analyses conducted in this thesis focused more on hypotheses of demographic transition theory (DTT).

Therefore, using the data from Census 2004 and the vital statistics report of 2004, standard DTT predictors, such as agricultural attainment, labor force participation, and educational attainment, all of which measure the level of socioeconomic development in the 231 Korean counties, were primarily examined to test the validity of the DTT hypotheses. Additionally, this thesis also examined the effects of women's status and traditional norms and cultural values on variation in fertility.

According to the 2004 vital statistics, the mean value of the general fertility rate is 34.36 (equivalent to a TFR level of 1.04) among the 231 counties of Korea, ranging from a low of 21.6 (equivalent to a TFR level of 0.6) in Gangseo-gu (in the Pusan municipality) to a high of 54.31 (equivalent to a TFR level of 1.62) in Hwacheon-gun (in the Kangwon-do province). This variance in the GFR among the counties is slightly greater than in the provinces, but even the high GFR values in their ranges are very low.

As demonstrated in Chapter IV (see **TABLE 1**), most counties with the lowest GFR are found in the Pusan municipality, and their GFRs were equivalent to TFRs of less than 1.0. Pusan municipality is the second largest city after the Seoul municipality (the capital city of Korea), well-known as one of the most socioeconomically developed cities in Korea. On the other hand, most counties with high GFRs are found in the provinces (Kangwon, Chollanam-do, Kyongsangbuk-do, and Kyongsangnam-do) which

have high levels of agricultural attachment. After all, these descriptive data lend support to the base of demographic transition theory.

This thesis, however, has a unique strength which can contribute to the analysis of Korea's current level of fertility, since the Korean government seeks to find solutions for the extremely low levels of fertility across the country. Considering the fact that the government's family planning policy presently has no significant effect on fertility change, the question remains: what could account for the geographic variance in fertility in Korea? Also, what are the most influential effects of the low levels of fertility at the county level? I hoped to find the answers to these questions through the analyses conducted in this thesis. Furthermore, few analyses of a similar nature have been done previously, so this thesis could be a contribution to studies on the patterns of low fertility in Korea.

I will now summarize the results of the analyses conducted in this thesis and discuss the implications of its findings.

This thesis estimated several OLS (Ordinary Least Square) regression models for predicting the GFR, in order to examine the hypotheses of the DTT. Before estimating the regression equations, several diagnostic tests were employed to ensure the statistical accuracy of the regression analyses. First of all, two independent variables such as the percentage of educational attainment and the sex ratio of the percentage of educational attainment were modified by a log transformation due to their skewness. In addition, I appraised the zero-order correlations of the independent variables with the dependent variable of the GFR, and each with one another. As shown in **TABLE 3**, many

independent variables are collinear with one another, implying that there is a problem of multicollinearity. Scatterplots visually showed the correlated direction of these bivariate relationships (see **FIGURES 4-11**). Considering the problem of multicollinearity, I divided my analysis into eight multiple OLS regression analyses. After estimating the regression equations, I also calculated tolerances for each independent variable in order to make sure that each model had no multicollinearity among the variables. All the tolerances were at statistically acceptable levels.

Models 1 and 2 each included five independent variables which represented three different characteristics: socioeconomic development, women's status, and traditional norms and cultural values (see **TABLE 4**). In Model 1, three effects on the GFR, namely the percentage of labor force participation, the sex ratio of the percentage of educational attainment, and the marriage rate, were all significant. However, only two independent variables were found not to be consistent with the hypotheses: the percentage of labor force participation and the divorce rate. Particularly, despite its significant effect on the GFR in Model 1, the percentage of labor force participation was positively related to the GFR, in opposition to the DTT hypothesis. The coefficient of the divorce rate was also signed in the wrong direction, but was not statistically significant. In Model 2, all coefficients were significantly related to the GFR in the hypothesized directions.

Consequently, the results from Models 1 and 2 seem to support the DTT hypotheses. Two DTT variables, the percentage of labor force participation and the percentage of educational attainment, were significantly associated with the GFR in

Models 1 and 2. Also, the percentage of educational attainment showed the hypothesized effect in Model 2, but the percentage of labor force participation was related to fertility in the wrong direction.

The result of the percentage of labor force participation in Model 1 can be interpreted in two ways. Firstly, according to the descriptive data shown in Chapter IV, most counties with the loftiest percentage of the population in the labor force were in provinces with the highest levels of agricultural attachment. In other words, the percentage of the population in the labor force tended to be higher in rural areas than in urban areas. As discussed earlier, this could be explained by the fact that after the national financial crisis in Korea of 1997, the number of white collar jobs was significantly reduced in urban areas, so that the unemployment rate became higher in urban areas than in rural areas. After all, a high percentage of the population in the labor force found in the 2004 census would have been concentrated in agriculture. Secondly, even though rural areas have a higher level of labor force participation than urban areas, their TFR level is not greater than 1.62, still indicating a very low fertility rate. Given that the TFR range was 0.6 to 1.62 among Korea's counties in 2004, both rural and urban counties have very low fertility, irrespective of the effect of labor force participation.

Models 3-5 employed each of the socioeconomic variables, along with all of the cultural variables (see **TABLE 5**). In these models, three socioeconomic variables, namely, the percentage of the population involved in agriculture, the percentage of educational attainment, and the percentage of labor force participation were all

significantly associated with the GFR in the hypothesized directions, except for the percentage of labor force participation. Although labor force participation was opposite to the direction hypothesized in Model 5, other socioeconomic variables were compatible with my expectations. Among the cultural value variables, only the marriage rate was significantly and positively related to the GFR in all of the models. The sex ratio at birth was consistent with the hypothesis in all models, but not statistically significant. The coefficient of the divorce rate was significant in Models 3 and 4, but only signed in the hypothesized direction in Model 4.

Consequently, the results of Models 3-5 show that the DTT hypotheses work well for predicting the GFR, in spite of the fact that in Model 5 the percentage of labor force participation was related to the GFR in the wrong direction, which was also shown earlier in Model 1. Also, contrary to expectations, the results of the divorce rate were not consistent in all three models. This cultural variable is significantly associated to the GFR in the hypothesized direction only in Model 4.

Models 6-8 examined the impact of women's status and cultural values on the GFR among the 231 counties in Korea (see **TABLE 6**). The two women's status variables were both significant in the models, but only the sex ratio of the percentage of educational attainment was in accordance with the hypothesis. The findings from Models 7 and 8 showed that the percentage of female labor force participation was significantly and positively related to the GFR, which is the same as the results of the percentage of labor force participation on the GFR in Models 1 and 5. However, in the findings of Models 6-8, only one cultural value variable, the marriage rate, was

significant and with the hypothesized effect on the GFR. The coefficient of the sex ratio at birth had the hypothesized relationship to the GFR but was not significant in all models. The results from Model 6 showed that the divorce rate was negatively related to fertility, as hypothesized, but not statistically insignificant.

The results from Models 6-8 indicate that women's status variables are significantly associated with the GFR. In particular, the coefficient of the sex ratio of the percentage of educational attainment above a university degree showed the hypothesized effect on the GFR, and was significant in all models in which it was examined. On the other hand, the coefficient of the female labor force participation was significant but not consistent with the hypothesis.

Through all these analyses, the DTT predictors seemed to be accounting for the variance in fertility rates among the 231 Korean counties in 2004. Although the levels of the GFR are extremely low all across the country, it seems that socioeconomic conditions kept having an impact on fertility differentials in Korea. Moreover, women's social status has also had a significant effect on the GFR. Since "the gender explanation of low fertility has received attention in recent studies" (D. Kim 2005: 16), many studies have suggested that there has been a remarkable improvement in gender inequality in educational attainment in Korea. However, despite this improvement, men do still have a higher level of educational attainment than women in Korea. The results of my analysis have shown that higher gender inequality in educational attainment above a university degree leads to a higher general fertility rate.

Previous fertility studies have suggested that the increasing incidence of divorce after 1990 has increasingly contributed to fertility decline in Korea. Son preference also has been regarded to have an important role in Korean women's fertility decisions, but Korea has achieved an extremely low level of fertility even with the culturally strong son preference. Unexpectedly, my results have shown that traditional norms and cultural values about marriage and fertility do not seem to have a significant impact on fertility differentials. With the exception of marriage, the effects of divorce and son preference on fertility were insignificant.

In this thesis, fertility variations and patterns of low fertility in South Korea were examined at the county level. Since Korea achieved the replacement level of fertility in 1984, its TFR level has gradually declined to the level of 'lowest-low fertility.' In 2004, county levels of the TFR varied from 0.6 to 1.62, indicating that, by and large, levels of fertility in Korea are extremely low. In the analyses of fertility variations in low fertility levels, the three different characteristic predictors of socioeconomic development, women's status, and traditional norms and cultural values were estimated to predict fertility.

For future improvement of my analyses, the predictors could be further enhanced and developed. For example, income levels and labor force involvement among white collar workers might be important socioeconomic indicators for predicting fertility change. In my analysis there were two problematic variables, namely, the percentage of labor force participation and female labor force participation. These two variables were positively related to fertility, a direction opposite to that of my hypothesis. The 2004

census data showed high total level of labor force participation, along with female labor force participation, to be more concentrated in areas involved in agriculture than those the primarily white collar areas. Consequently, these variables did not perform well in my analyses. Thus, I suppose that different measurements, i.e., total labor force participation or female labor force participation at the white collar level would be better for predicting fertility. Furthermore, income level would be a useful indicator measuring both socioeconomic conditions and women's status. Particularly, since many Korean women have obtained high levels of education and high-level incomes, this may have led to the pattern of low fertility in the country. Therefore, female income levels should have an important effect on the low levels of fertility in Korea. Nonetheless, these data were not available in the 2000 census and the 2004 vital statistics so were excluded from my analyses.

In addition, for further study, the infant mortality rate (IMR) and the aged dependency ratio (ADR) could both be employed as explanatory variables. According to demographic transition theory, the onset of infant mortality's decline generally proceeds with a starting point of fertility transition. Since the early 1960s, Korea has achieved a rapid fertility decline, along with infant mortality decline. In accordance with this basic postulation of the DTT, in Korea the IMR has been related to this fertility transition over the past two decades. Thus, this too should have a significant impact on Korea's fertility.

Another variable that could be included in future analyses is the aged dependency ratio (ADR). The rapid fertility and mortality declines have produced unprecedented increases in the older populations in Korea. The major municipalities

such as Seoul, Dae-gu, and Pusan, already contain large numbers of older and oldest-old people (Poston et al. 2004). Presently, this population's aging is occurring along with patterns of low fertility. Therefore, it could be argued that the aged dependency ratio, i.e., persons 65+ divided by persons 15-64, should be associated with fertility.

Moreover, for further my analysis, I hope to expand on this macro level study by estimating weighted regression equations. Considering the population contained in each county, the weighted analyses provide even more precise results for predicting fertility variation among the counties.

In response to the lowest-low fertility levels and the rapidly aging population, the Korean government has presently made a significant effort to boost its fertility rate. While the governmental family planning program was very effective in controlling the high rate of fertility between 1960 and the mid 1990s, this does not seem to have had a significant impact on the current low level of fertility in Korea. In the mid 1990s, the Korean government moderated its family planning efforts aimed at maintaining the TFR level of 1.7, but the TFR of Korea has continued to decline, and it now approaches its current 1.0 level. In 2004 the Korean government declared a policy shift to a pro-natal policy, focusing on "helping families by providing child allowances, childcare leave, a childcare support system, and tax exemptions based on the number of children" (D. Kim 2004: 18). However, in spite of this new pro-natal policy, the TFR declined from 1.16 in 2004 to 1.08 in 2005.

As with other low-fertility countries such as Japan and several European countries, the Korean government has attempted to promote childbirth by providing

economic incentives. However, the small amount of economic support and the low level of benefits compared to those of other countries are, together, unlikely to have a significant influence on young Korean couples (D. Kim 2004). Also, since these direct economic incentives have been mostly provided to married couples who already have children, the pro-natal policies do not seem to be very effective (D. Kim 2004). Several low-fertility European countries have already experienced the same failures with their pro-natal policies, which depend on economic benefits.

Undoubtedly, to encourage young Korean couples to have children, economic support for childcare would be a necessary component among the policy options. However, ultimately, it is more urgent to establish a better infrastructure and working environment for female workers that would enhance their roles as both mothers and workers. Although the participation of Korean women in the labor force has gradually increased over the past decades, gender discrimination in labor opportunities and unreasonable treatment of female workers in the workplace (e.g., less benefits, lower salaries, and wrongful dismissal) still exist today. I consider these factors to be a major obstacle for young Korean women when they make their fertility decisions.

Accordingly, the future pro-natal policy direction should be focused on “improving the social status of women and gender equity, and on guaranteeing the involvement of fathers in childcare and rearing responsibilities” (D. Kim 2005: 18). In actuality, some European countries, including France, have achieved an increase in the level of fertility by enhancing the compatibility of women’s work and childcare (Gauthier and Hatzius, 1997).

In future studies, researchers need to study further the relationship of low levels of fertility and pro-natal policies. Many countries from Europe and East Asia have already approached the lowest-low fertility level of 1.3 and have, consequently, enforced pro-natal policies. Without exception, the low fertility issue is an urgent problem for South Korea to resolve, especially with the rapid process of the population's aging. In the future, more research about the patterns of low fertility is needed to provide solutions to this most challenging demographic issue facing Korea and the world.

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APPENDIX A

TABLES

TABLE 1 Descriptive Statistics for General Fertility Rates and Socioeconomic, Female Status, and Cultural Variables: 231 Counties of South Korea, 2004

Variable	Mean	Standard deviation	Minimum value	Maximum value
General fertility rate	34.36	6.50	21.60 Gangseo-gu County (Pusan)	54.31 Hwacheon-gun County (Kangwon-do)
Sex Birth Ratio	109.70	9.76	68.42 Yeongyang-gun County (Kyongsangbuk-do)	156.25 Seongju-gun County (Kyongsangbuk-do)
Marriage Rate (25+)	8.22	1.90	4.23 Yeongyang-gun County (Kyongsangbuk-do)	12.46 Gwanak-gu County (Seoul)
Divorce Rate (25+)	3.89	0.98	1.56 Sunchang-gun County (Chollabuk-do)	7.12 Dongducheon-si County (Gyeonggi-do)
%Educational Attainment	10.63	7.00	1.96 Sinan-gun County (Chollanam-do)	42.24 Gangnam-gu County (Seoul)
%Labor Force Participation	57.39	6.71	43.40 Dong-gu County (Kwangju)	77.7 Sinan-gun County (Chollanam-do)
% Population Agriculture	21.31	20.49	0.00 25 counties in Seoul, Busan, Incheon municipalities	67.1 Sinan-gun County (Chollanam-do)
% Female Labor Force Participation	43.99	9.60	29.30 Gyeryong-si County (Chungchongnam-do)	71.1 Sinan-gun County (Chollanam-do)
Sex Ratio of %Educational Attainment (25+)	2.09	0.48	1.34 Seocho-gu (Seoul)	5.00 Hampyeong-gun County (Chollanam-do)

SOURCE: KOSIS, Korea National Statistical Office (KNSO)

TABLE 2 Skewness Tests for Normality

Variable	Mean	Median	Skewness
General Fertility Rate (GFR)	34.36	33.68	0.62
%Population Agriculture	21.31	15.8	0.42
%Educational Attainment	10.63	8.81	1.6
%Labor Force Participation	57.39	55.8	0.58
%Female Labor Force Participation	43.99	40.6	0.77
Sex Ratio of %Educational Attainment (25+)	2.09	2	1.67
Divorce Rate	3.89	3.97	0.14
Marriage Rate	8.22	8.2	0.13
Sex Ratio at Birth (SRB)	109.7	108.98	0.89
log%Educational Attainment	2.17	2.18	0.11
log Sex Ratio of %Educational Attainment	0.72	0.69	0.69

SOURCE: KOSIS, Korea National Statistical Office (KNSO)

TABLE 3 Zero-order Correlations of Dependent and Independent Variables: 231 Counties of South Korea, 2004

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) General Fertility Rate (GFR)	—								
(2) % Population Agriculture	-0.0004	—							
(3) log% Educational Attainment	-0.012	-0.868	—						
(4) % Labor Force Participation	0.147	0.855	-0.796	—					
(5) log Sex Ratio of % Educational Attainment	0.096	0.778	-0.763	0.711	—				
(6) % Female Labor Force Participation	-0.002	0.907	-0.818	0.948	0.717	—			
(7) Sex Ratio at Birth	0.024	0.210	-0.214	0.243	0.230	0.233	—		
(8) Marriage Rate (25+)	0.495	-0.736	0.651	-0.509	-0.603	-0.634	-0.170	—	
(9) Divorce Rate (25+)	0.238	-0.698	0.432	-0.542	-0.461	-0.637	-0.123	0.651	—

SOURCE: KOSIS, Korea National Statistical Office (KNSO)

TABLE 4 Multiple Regression Coefficients for the GFR on Socioeconomic, Female Status, and Cultural Values Variables: 231 Counties of Korea, 2004

Independent Variables	Model 1	Model 2
% Population Agriculture		
Log% Educational Attainment		-3.088*** (-0.295)
% Labor Force Participation	0.302*** (0.312)	
%Female Labor Force Participation		
Log Sex Ratio of %Educational Attainment	13.059*** (0.421)	13.422*** (0.433)
Divorce Rate (25+)	0.126 (0.019)	-0.589 (-0.089)
Marriage Rate (25+)	3.070*** (0.896)	3.458*** (1.010)
Sex Ratio at Birth	0.004 (0.006)	0.015 (0.022)
Constant	-18.474	3.731
R-squared (adjusted)	0.524	0.514

* P < 0.05, ** P < 0.01, *** P < 0.005; Standardized Coefficients in Parentheses

SOURCE: KOSIS, Korea National Statistical Office (KNSO)

TABLE 5 Multiple Regression Coefficients for the GFR on Socioeconomic and Cultural Value Variables: 231 Counties of Korea, 2004

Independent Variables	Model 3	Model 4	Model 5
% Population Agriculture	0.278*** (0.877)		
Log% Educational Attainment		-5.947*** (-0.568)	
% Labor Force Participation			0.531*** (0.549)
%Female Labor Force Participation			
Log Sex Ratio of %Educational Attainment			
Divorce Rate (25+)	1.242*** (0.188)	-0.902* (-0.136)	0.369 (0.056)
Marriage Rate (25+)	3.511*** (1.025)	3.293*** (0.962)	2.542*** (0.742)
Sex Ratio at Birth	0.024 (0.036)	0.033 (0.049)	0.016 (0.024)
Constant	-7.911	20.121	-20.174
R-squared (adjusted)	0.545	0.442	0.452

* P < 0.05, ** P < 0.01, *** P < 0.005; Standardized Coefficients in Parentheses

SOURCE: KOSIS, Korea National Statistical Office (KNSO)

TABLE 6 Multiple Regression Coefficients for the GFR on Female Status and Cultural Values Variables: 231 Counties of Korea, 2004

Independent Variables	Model 6	Model 7	Model 8
% Population Agriculture			
Log% Educational Attainment			
% Labor Force Participation			
%Female Labor Force Participation		0.363*** (0.537)	0.169*** (0.250)
Log Sex Ratio of %Educational Attainment	18.741*** (0.605)		15.032*** (0.485)
Divorce Rate (25+)	-0.481 (-0.073)	0.428 (0.065)	0.069 (0.010)
Marriage Rate (25+)	3.124*** (0.912)	2.742*** (0.801)	3.226*** (0.942)
Sex Ratio at Birth	0.020 (0.031)	0.028 (0.043)	0.010 (0.015)
Constant	-5.111	-8.943	-11.756
R-squared (adjusted)	0.484	0.401	0.505

* P < 0.05, ** P < 0.01, *** P < 0.005; Standardized Coefficients in Parentheses

SOURCE: KOSIS, Korea National Statistical Office (KNSO)

APPENDIX B

FIGURES

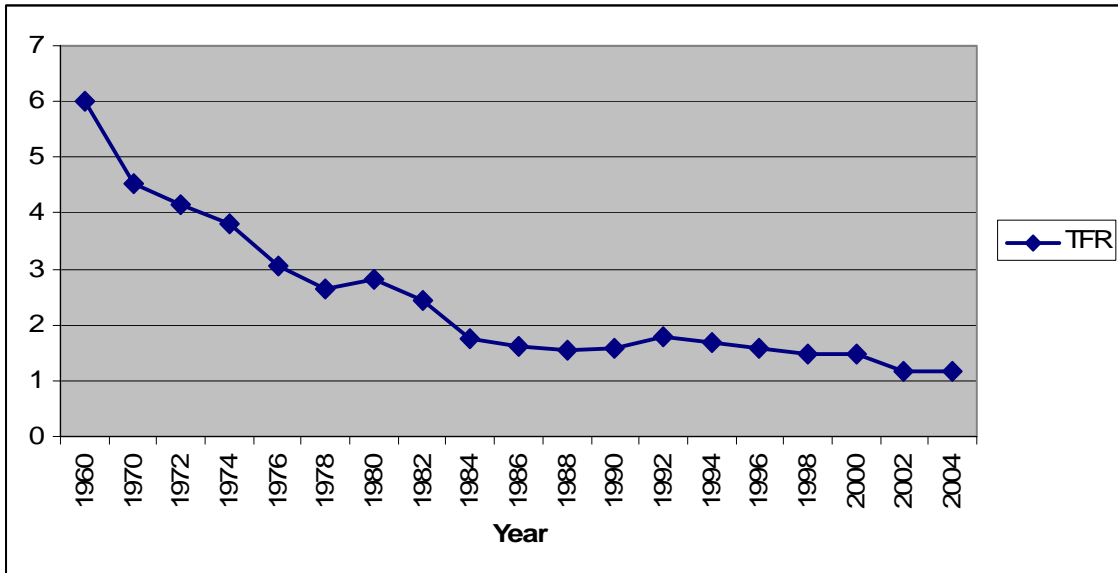


FIGURE 1 Total Fertility Rate: South Korea, 1960-2004

SOURCE: KOSIS, Korea National Statistical Office (KNSO)

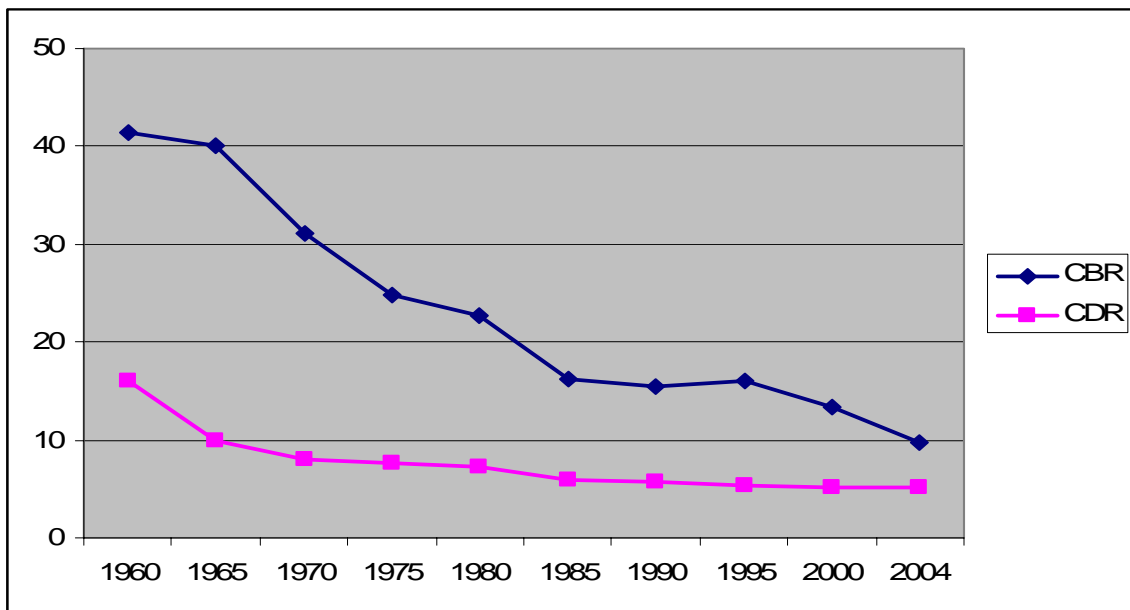


FIGURE 2 Crude Birth Rate & Crude Death Rate: South Korea, 1960-2004

SOURCE: KOSIS, Korea National Statistical Office (KNSO)



FIGURE 3 Geographical Subdivisions in South Korea

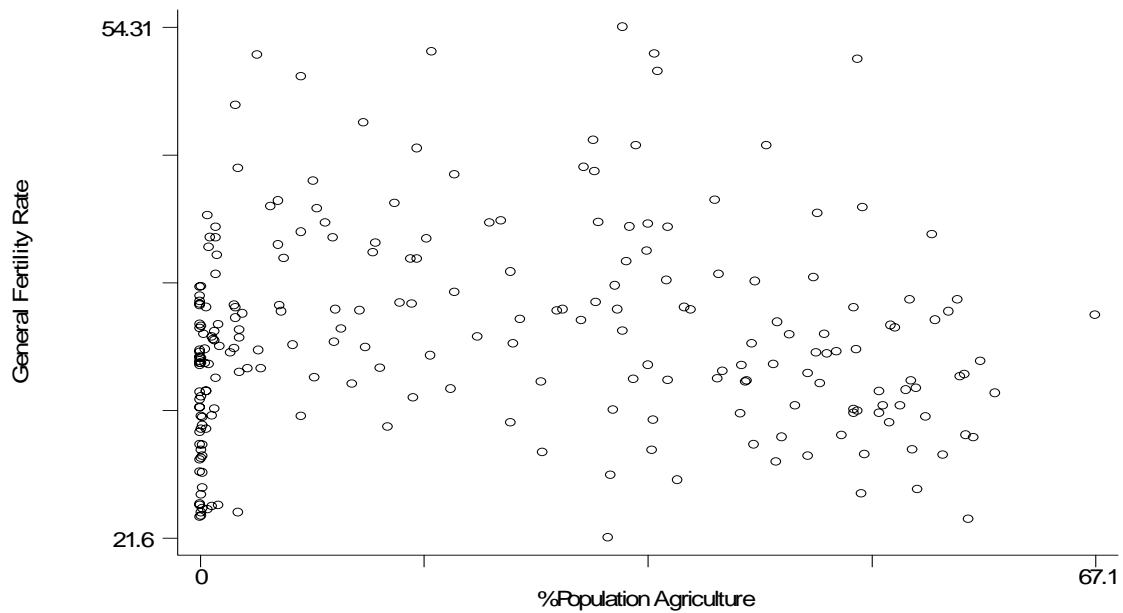


FIGURE 4 GFR & Percentage Population Agriculture ($r = -0.0004$)

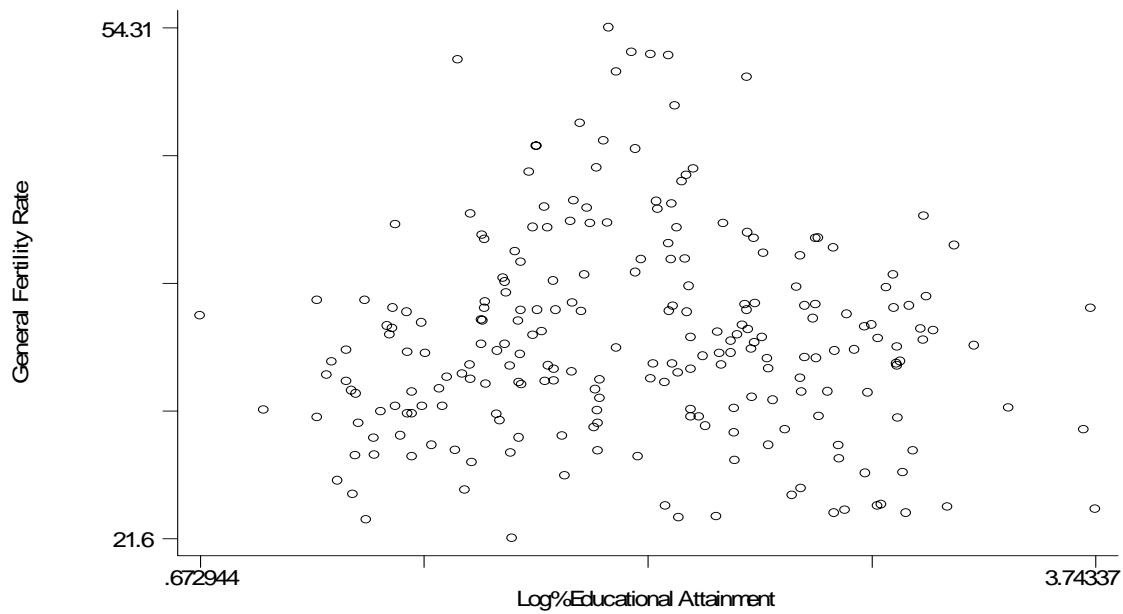


FIGURE 5 GFR & Percentage Educational Attainment ($r = -0.012$)

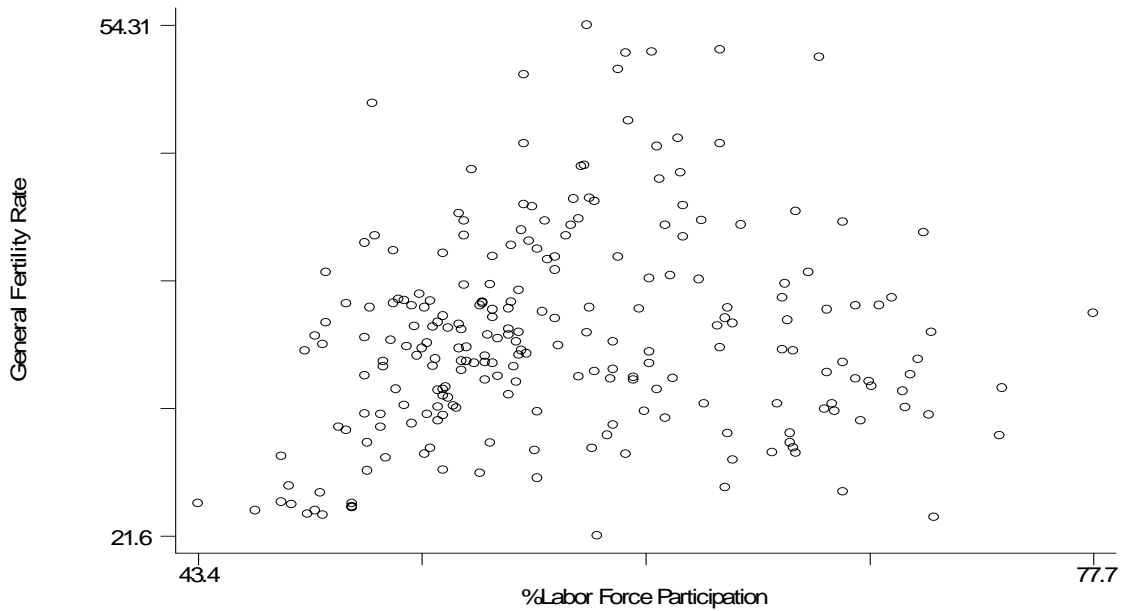


FIGURE 6 GFR & Percentage Labor Force Participation ($r = 0.147$)

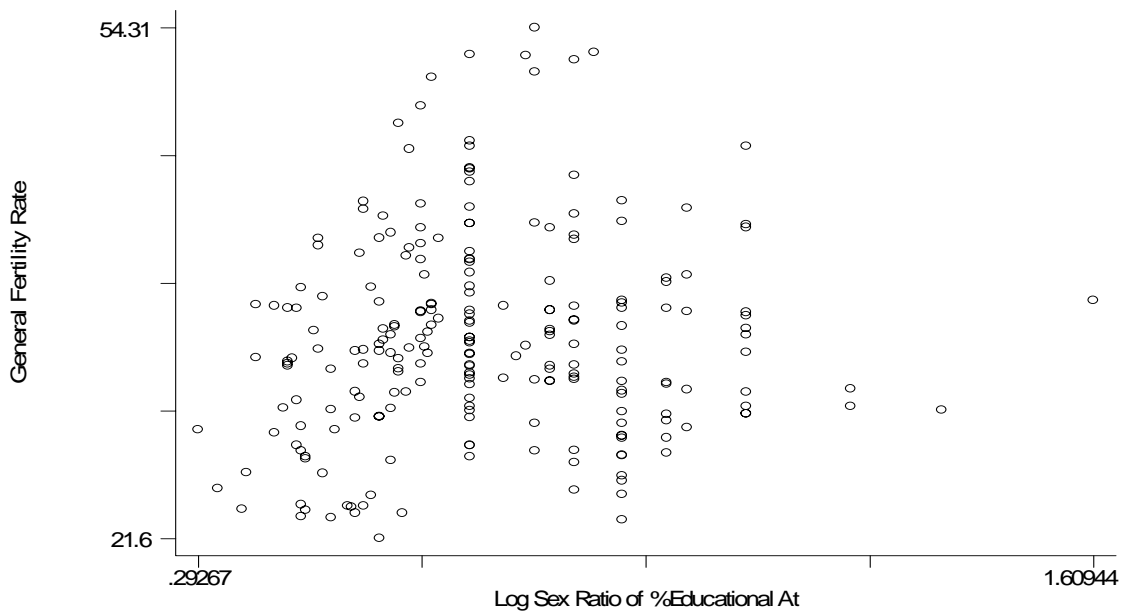


FIGURE 7 GFR & Sex Ratio of Percentage Educational Attainment ($r = 0.096$)

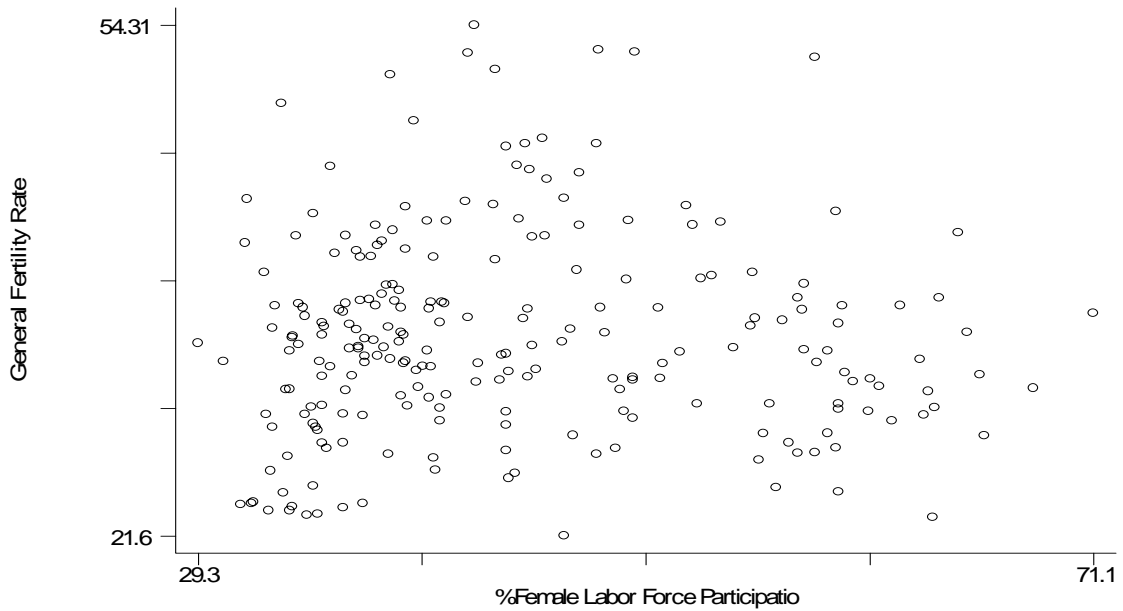


FIGURE 8 GFR & Percentage Female Labor Force Participation ($r = -0.002$)

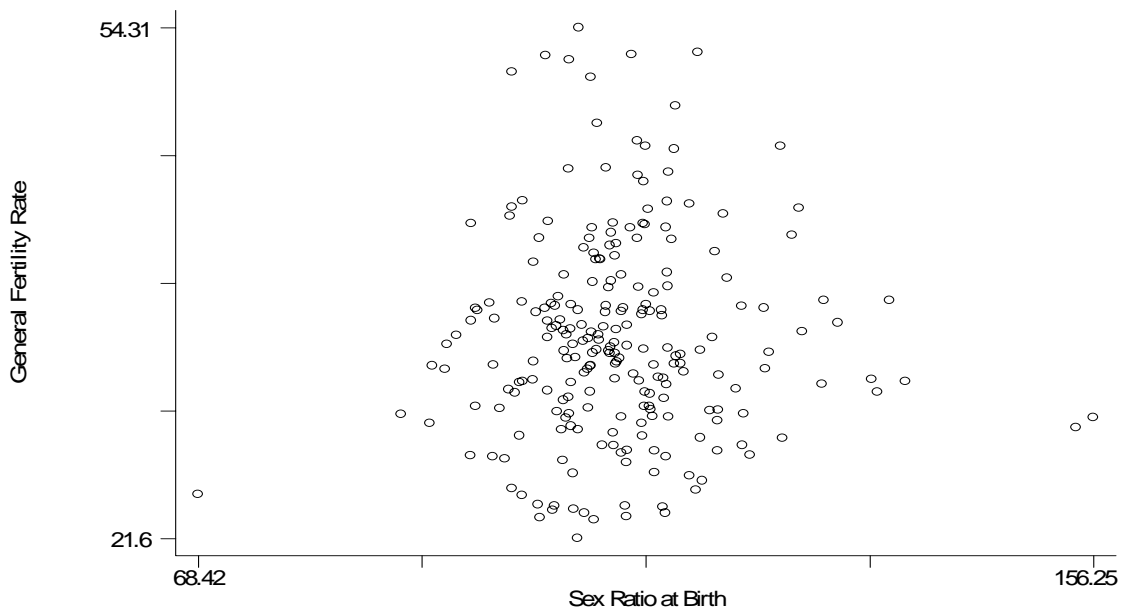


FIGURE 9 GFR & Sex Ratio at Birth ($r = 0.024$)

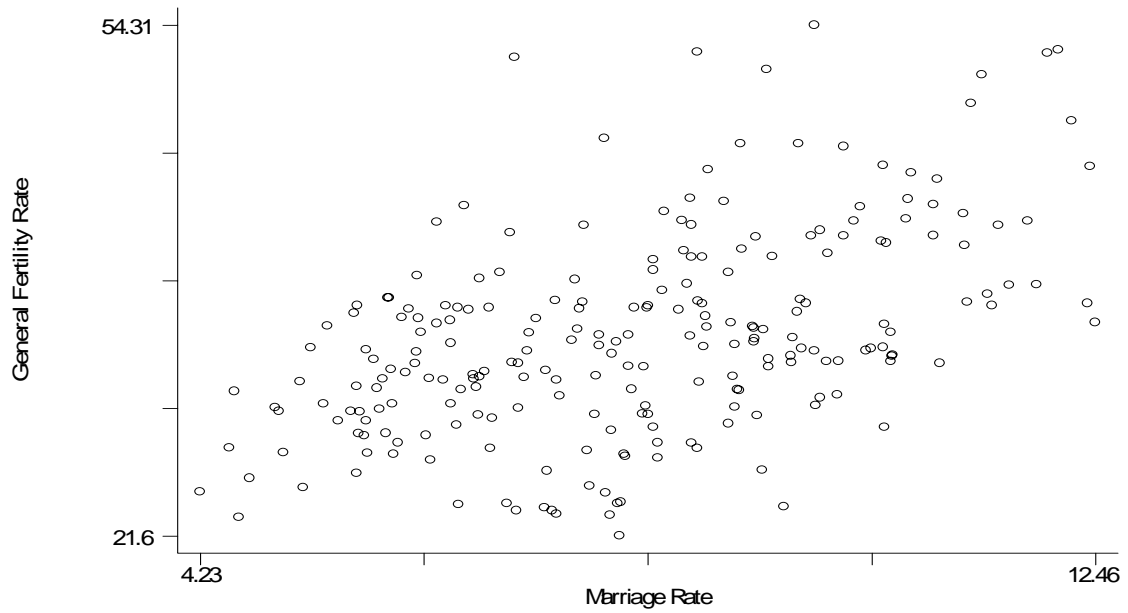


FIGURE 10 GFR & Marriage Rate ($r = 0.495$)

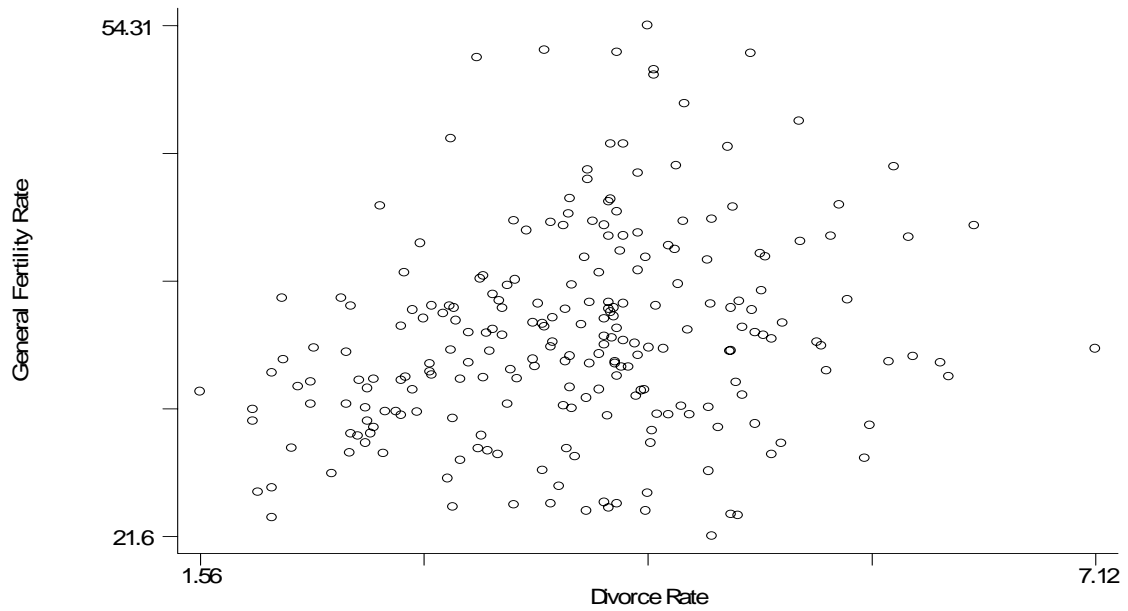


FIGURE 11 GFR & Divorce Rate ($r = 0.238$)

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