EVALUATION OF THE EFFICACY OF THE CHILDBIRTH GRANT IN KOREA 2006-2012

By

LIM, Youngju

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Submitted to
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Committee in charge:

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ABSTRACT

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As local governments have competitively introduced childbirth grants to increase the total birth rate, there has been much debate on policy impact. Some research studies estimate the effectiveness of childbirth grants on the fertility rate; however, most used macro-level data that cannot cover the birth decisions of individual households.

This study conducted empirical analysis to investigate the birth interval using micro panel data while taking note of the childbirth grant to minimize the debate stated above. Besides this, other factors affecting fertility were also examined for fertility policy implementation.

By using KLIPS data (9^{th}–15^{th}), this study derived data of 978 mothers of newborn babies (born 2006–2015) and household. This research apprehended the general characteristics of the sample and the trends of the birth interval through Kaplan-Meier estimation. In addition, by using the Cox proportional hazard model, this study investigated economic factors (including the weekly wages of mothers, total household income, and labor force participation of mothers), socio-demographic factors (married age, education level, and the presence of grandparents), and childbirth grant policy on birth spacing.

The results of this study are as follows:

First, the birth interval from previous birth to next birth was about 33.3 months. In other words, children within a family were spaced an approximate average of 2.9 years apart.

Second, the childbirth grant had no significant impact on the birth interval. It appeared that other policy measures were necessary to increase fertility while providing temporary financial transference.

Third, the labor force participation of mothers, the weekly wage of mothers, and the age of marriage had a statistically significant impact on the birth interval. The birth interval of mothers who currently work was shorter than those of full-time mothers. Mothers who had a higher weekly wage tended to have a longer birth interval. The older the mother, the longer the birth interval. Thus, the labor market policies for women are one of fundamental issues related with low fertility problem.

Despite its limitations, it is meaningful that this study assesses the longitudinal impact of childbirth grants on the birth interval based on micro-level KLIPS data for 2006–2012.

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I. Introduction

1.1 Background

Over the past few years, Korean local government has used a childbirth grant as a policy instrument to counteract the low fertility rate. The desirable outcome of the childbirth grant policy[1] is to increase the fertility rate among recipients.

In spite of the hypothesis about whether a childbirth grant can be an efficient policy tool to increase fertility, there are a lot of debates about whether there it has had a significant impact. In the context of Korea, it is peculiar that local governments have extended the childbirth grant policy for more than ten years, even if there are insufficient researches into its effectiveness. After implementing the childbirth policy for ten years, some local governments have cut down its budget in a stance that is skeptical about its effect on the fertility rate.[2]

As the debate has continued for several years, the purpose of this study is to evaluate the efficacy of the childbirth grant in Korea using panel data spanning eight years, from 2006 to 2012, in the hope that it would be groundwork for birth encouragement policy implementation.

The paper is organized as follows: Part 2 will provide literature reviews of related issues, part 3 describes the data and methodology, part 4 will report the empirical results, and the last part will present conclusions and discussions.

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[1] It can be also called as “baby bonus”.

[2] Seocho borough (in Seoul) will abolish the childbirth grant from 2016, Incheon City has already reduced the amount of the childbirth grant for third child from 300 to 100 million KRW in 2014. Gyungsangbuk Province, Gwangju-dong District and 17 cities of Gyeonggi Province cut down its budget for the childbirth grant.

1.2. Statement of the Problem and Justification

Approximately 20 of the 27 OECD countries currently carry out some form of birth grant policy, their aim is to alleviate the direct cost of children and raise the total fertility rate. With this OECD trend, Korea—the lowest low-fertility country among the OECD countries, the total fertility rate was 1.2 children per woman in 2011—implemented a childbirth grant policy to increase the fertility rate (OECD, 2011).

Despite the growth of the childbirth grant, it has been criticized as a temporary reward for families that have already experienced a birth. Even though it helps reduce the costs associated with raising children, questions have been raised about whether a childbirth grant can provide mothers with practical help, as it does not seem to have influenced fertility outcomes. The notion is advanced that various policy measures such as creating work-family compatible environments, enforcing family-friendly policies for women, and providing qualified kindergarten care environments should also be considered; currently, local governments appear to have concentrated on this single, temporary reward.

Furthermore, many local governments suffer from the financial burden the childbirth grant entails. The budget for the childbirth grant entirely depends on each local government. Many local governments have reported budget deficits and find it difficult to maintain financial stability.[3] Some regions have even drawn up a revised supplementary budget for the childbirth grant.[4]

A balanced approach is required when it comes to making a fertility support system with a limited budget. It is crucial to reach the ultimate policy goal of raising fertility while keeping local government finances sound. It is essential to evaluate the efficacy of the current policy to achieve this.

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3 Namyangju-city, Seongnam-city, Gyeyang-borough, Incheon-city.
4 Ansan-city, Hoengseong-district.

1.3. Overview of childbirth grant policy

Local governments started the childbirth grant policy in 2002[5]. At the first stage of the policy's implementation, there were concerns about population outflow in rural and fishing areas. Consequently, the childbirth grant policy started to prevent the outflow of population and the decline in the fertility rate. It expanded nationwide, joining up 193 local governments in 2011. Currently, the goal of the childbirth grant policy is to increase the population in each local government–controlled area by raising the fertility rate (Song and Kim, 2013:1).

As the childbirth grant is financed from the local government budget, each local government has the power to decide upon targeted recipients, recipient selection criteria, and the amount of money they are going to provide.

The recipients of childbirth grants are required to have been registered residents for more than a certain period before giving birth, and the amount of money is different for each local government and by birth order. Parents apply for and receive their birth grants at the local community service center.

The total estimated budget for childbirth grant has increased each year: It was 3.7 billion KRW in 2006, 6.96 billion KRW in 2007, 9.52 billion KRW in 2008, and 9.77 billion KRW in 2009 (Choi and Song, 2010:106). It appears that 0.003–0.009% of nominal GDP, a considerable sum of money, has been spent on the childbirth grant. Now, questions are being raised about whether the original goal of the childbirth grant on fertility is being achieved by this substantial government budget spend.

[5] Hampyeong, Jeolla nam Province introduced the childbirth grant policy for the first time among local governments since 2002 (Lee Jung-Chul, 2012:55).

1.4. Purpose and Research Questions

The purpose of this research is to evaluate the childbirth grant policy's effect on fertility in Korea, using panel data from the Korea Labor and Income Study (KLIPS) over eight years, 2006–2012.

The research questions are as follows:

1. Does the amount of the childbirth grant reduce the birth interval?

2. What factors other than the childbirth grant can affect a reduction in the birth interval? What factors should be considered to encourage fertility policy?

II. Literature reviews for theoretical framework

2.1. The financial transfer to increase fertility

2.1.1. Theoretical background of financial incentives on fertility decisions

There is a theoretical logic behind the childbirth grant policy. Classical research about the economic analysis of fertility conducted by Becker (1960) suggested an economic framework to the analysis of family size decisions. He considered children as goods, and suggested that the fertility decision is primarily affected by income and child costs. A marginal increase in income and a marginal decrease in prices leads to parents deciding to have more children. Parents would make a maximized utility decision after fully considering their income constraints and the costs of having children. This implies that the birth decision can be affected by releasing revenue constraints by providing cash transfers.

2.1.2. Classifications of financial transfers

In this context, developed countries develop financial incentives to overcome low total fertility rate problems. According to Luci and Thevenon (2012:10), financial incentives can be sorted into two forms: Cash transfer and tax benefits. “Cash transfer” includes two categories: childbirth grant and family allowances. “Childbirth grant” is given to parents just once after they give birth, whereas “family allowances” are paid on a regular basis.

The “tax benefit” includes tax allowances on earned income, tax credits, or tax deductions for childcare services (Luci and Thevenon, 2012:11). All of these policy tools are used to reduce the financial burden of the cost of child for each household.

2.1.3. Financial incentive policy instruments on fertility in Korea

In Korea, there are significant policies to reduce parents' financial burden conducted by both the central government and local government. First, there are the major financial incentive policies implemented by the central government, which are the "Childcare subsidy policy" and "Childcare allowance." The "Childcare subsidy policy" is for parents with children aged 0–5 who use a kindergarten or daycare center. The "Childcare allowance" is for mothers who care for their children in their home without making use of a kindergarten or daycare center.

Childcare subsidy policies can be sorted into tax benefits and deductions for childcare services. A childcare allowance is classified as a family allowance by its regular basis. (Luci and Thevenon, 2012:11).

Second, local governments conduct several fertility policies separately from the central government, such as "childbirth grant," "in-kind maternity bag," and "paying insurance for newborn babies." The childbirth grant policy is to give some amount of cash to mothers when they give birth in that region, which was the most strongly highlighted among the above policies. This study focuses on childbirth grant policies conducted at the local government level, not on central government policies.

Based on the classification of Luci and Thevenon (2012), childbirth grant is a type of birth grant, which is a lump sum of money paid once around the time of a birth. Among the financial incentive tools on fertility, the scope will be focused on the childbirth grants in this study. As national research institutes actively carry out the evaluations of childcare subsidy policies and childcare allowance policies, however, still researches about local government childbirth grant policy are relatively less highlighted.

2.2. The effect of childbirth grants on fertility

2.2.1. Methodology used to analyze childbirth grant policies

2.2.1.1. Macro-level data usage

As the budget allocated to childbirth grants continues to grow, many economic and public administration journals have evaluated the effect of childbirth grants on fertility rates. Most of the literature uses macro-level data via regression analysis (Suk Ho-won, 2011; Lee Seok-hwan, 2014; Lee and Shin, 2013) and panel fixed model analysis (Lee Seok-hwan, 2014; Lee Myeong-seok et al., 2012).

They used data compiled by the National Statistical Office (Lee Seok-hwan, 2014; Lee Myeong-seok et al., 2012; Lee and Shin, 2013): (1) the total fertility rate as dependent variable, and (2) socio-economic characteristics as control variables such as the crude marriage/divorce rate, the average age at first marriage, and the ratio of fertile women.

As to the key variable childbirth grant, many of studies subdivided the childbirth grant at metropolitan (Cities and Provinces) and City, District, Borough (Si, gun, gu) levels. Otherwise, it is sorted by birth order or policy dummy existence.

2.2.1.2. Micro-level data usage

However, parents' decisions affect childbirth. For such reasons, it is important to include parents' individual characteristics. Micro-level data analysis is a useful tool for determining personal characteristics.

In Korea, there is only one study that used microdata for childbirth grant policy evaluation (Song and Kim, 2013). By using data from the National Women and Family's Panel, they conducted a cross-section analysis in 2008. The major limitation of this study is the available data. At the time of the research period, one year of 2008 data was available to the general public, which is too short a period to gain actual fertility information. Instead of using actual fertility information, they used the next best thing, fertility-intention, as their dependent variable. The survey asked mothers whether they had fertility-intentions. However, it is hard to consider fertility-intentions as an actual fertility outcome variable.

2.2.2. The empirical studies of Childbirth grant in Korea

The results of a relatively recent journal on the impact of childbirth grant policies after 2012 targeted to analyze all local governments are as follows:

Park and Song (2014) analyzed the childbirth grant policy of the whole nation's 230 local government organizations for 2005–2010 using the panel fixed effect. Increasing one unit of the marginal childbirth grant can significantly increase the number of first and second child statistically. However, the third child was not affected by the childbirth grant. They suggested policy implication to increase the childbirth grant for first- and second-born children.

Lee Seok-hwan (2014) examined the effect of the childbirth grant in 230 local government organizations for 2001–2010 using panel fixed effect, and found that there is a statistically significant positive relationship between the childbirth grant and the fertility rate. Similar to the result in Park and Song (2014), there is a positive impact on the first and second child, but not on the third child.

Lee Myeong-seok et al. (2012), studied 230 local government organizations for 2005–2009, and also found a statistically significant positive effect of the childbirth grant on the fertility rate.

Song and Kim (2013) analyzed the impact of the childbirth grant on next birth-intention. When the childbirth grant was provided, the intention of having one child increased; however, the childbirth grant did not influence the two children birth intention. They recommended reinforcing support for a second birth to improve the policy's efficacy.

[Table 1] The empirical studies of the childbirth grant in Korea

Researcher (year)	Objective (year)	Methodology	Dependent variable	Independent variable	effect
Macro level study					
Suk Ho-won (2011)	25 borough in Seoul (2005-2009)	Multiple panel regression	- Total fertility rate - The number of childbirth - The age-specified fertility rate (National statistics)	- The childbirth grant dummy - The childbirth grant budget - The amount of the childbirth grant by birth order - Other fertility policies - Female population rate - Aging index - The average monthly wage - University entrance rate - Educational financing subsidy - Crude marriage/divorce rate - Ratio of household labor division - The number of day care center - Satisfaction with family life	(-)
Hong So-Jeong (2011)	25 borough in Seoul (2005-2008)	- Difference in Difference - OLS Regression	- Total fertility rate - The number of childbirth - The age-specified fertility rate (National statistics)	- The amount of the childbirth grant by birth order - Female population rate - The average age of female (15~49) - The collected amount of property tax	(-)

Researcher (year)	Objective (year)	Methodology	Dependent variable	Independent variable	effect
Park chang-woo Song Heon-jae (2014)	230 local gov't (2005-2011)	- Panel Fixed-Effect	- The number of childbirth (National statistics)	- The amount of the childbirth grant of each local government (pay in lump sum/installments) - Age at the first marriage - Crude marriage/divorce rate - The number of day care center - GRDP per capita - The number of childbearing age women	(+)
Lee Seok-hwan (2014)	230 local gov't (2002-2010)	- Panel fixed-effect - Multiple Regression - Correlation	- Birth rate (National statistics)	- The existence of the childbirth grant(dummy) - The total amount of the chhildbirth grant of each local gov't - The marriage rate - The rate of childbearing age women - The level of education - The local taxes per capita - The rate of legally permitted total ground area - The crude marriage rate	(+)
Lee Myeong-seok Kim Geun-se Kim Dae-gun (2012)	230 local gov't (2002-2010)	- Panel fixe-effect	- Total fertility rate (National statistics)	- The amount of the childbirth grant of each local government (Metropolitan level and city, district, borough level, total sum) - The crude marriage/divorce rate - The ratio of rural population - Automobile tax - The number of day care center per 1000 people - The number of birth encouragement policy	(+)

Researcher (year)	Objective (year)	Methodology	Dependent variable	Independent variable	effect
Lee Choong-hwan Shin Jun-seob (2013)	181 local public official (2009)	- Multiple regression	- Total fertility rate (National statistics)	- Birth encouragement policies including the childbirth grant - The number of daycare center - The usage rate of daycare center - The divorce rate/marriage rate - The rate of labor force participation of women - The rate of labor force participation of young man	(+)
Micro level study					
Song Heon-Jae Kim Ji-Young (2013)		- Probit	- Next birth intention (KLoWF panel data, 2008)	- The amount of the childbirth grant of each local government (Metropolitan level and city, district, borough level, total sum) - The age of parents - The education level of parents - The years of marriage - The number of children in household - The average age of children in household - Daughter/son dummy - The private education ratio - The private education expenses per children - The household income - The net asset of household - The average consumption of household for month - Mothers' labor force participation dummy	(+)

2.3. Economic and socio-demographic factors affect fertility

2.3.1. Economic factors affect fertility

According to advanced research, there are various factors that affect fertility other than the childbirth grant. First, economic factors are as follows: The wage rate of women, monthly income of their spouse, and female labor force participation.

2.3.1.1. The wage rate of women and non-housewife income

Women's pay rate can affect fertility rates as follows: The cost of childbearing can be worked as an opportunity cost for women. Thus increasing their wages has a negative effect on fertility.

Heckman and Walker (1990) pioneered research into the impact of wage rate on women and spouse income on fertility. They analyzed Swedish fertility data using duration analysis. The result showed that women's higher weekly wage level made the first birth interval longer. Moreover, if the monthly wage of their spouse was higher, the birth interval was shorter.

In Korea, inspired by Heckman's research, Min Hee-chul (2008) investigated KLIPS data using duration analysis to discover that women's weekly wages and the monthly income of their spouse may reduce the birth interval. The results showed that women's wages may delay the first birth interval. The wage of their spouse did not affect the first birth, but it brought the second birth interval forward by a statistically significant degree.

Kim Jungho (2009) suggest that increasing the female wage by 10% can decrease the second birth hazard by 0.56–0.92%, and that increasing the spouse's wage by an equal amount accompanied a rise in second birth hazard of 0.36–1.13%.

In summary, three of the research projects used duration analysis and showed that mothers with higher wages had longer birth interval by a statistically significant degree. In addition, the higher monthly income of spouse tends to reduce the birth interval, but its effectiveness differed from over time and was statistically insignificant.

2.3.1.2. Labor force participation of mothers

The effect of the labor force participation of mothers on fertility is ambiguous. It can be interpreted as the two hypotheses of Min and Kim (2011:201). The first hypothesis is that women try to lessen the birth interval to reduce the period of career discontinuation (Keyfits, 1980: Min and Kim, 2011). The second is that women tend to lengthen the birth interval to reduce the negative effects of career discontinuation.

Within the same report, women who have never participated in the labor force or who have already exited the labor market have a shorter birth interval than those who are currently in the labor force (Ram and Rehim, 1993; Min and Kim, 2011).

In addition, mothers who have a regular job status and continuously work after their first birth tend to have second children earlier (Min, 2007). She suggested that occupational stability is important in the birth decision.

Interestingly, recent studies have shown that mothers' labor participation has a positive impact on the fertility rate as social conditions have improved (Lee and Shin, 2011:102). However, due to the shortage of mother-friendly working places and welfare systems, researchers expect increasing the rate of women's labor force participation can makes low fertility rate in Korea (Lee and Shin, 2011:102).

2.3.2. Socio-demographic factors affect fertility

There are socio-demographic factors that influence fertility, including the mothers' age at marriage, the mother's level of education, and the presence of grandparents in a household.

2.3.2.1. The age at marriage

According to advanced research studies, late marriage and low fertility are not directly connected. Eun Gi-su suggested that the age of marriage did not influence the first birth interval (Eun, 2001a). In addition, mothers who married before a marriageable age have a longer birth interval than mothers who married after a marriageable age (Eun, 2001b). Even though late-married mothers tend to reduce the first birth interval, they also avoid or delay the second birth. Min and Kim (2011) suggested policy initiatives to lead the second birth of late mothers.

2.3.2.2. The mothers' level of education

Many research studies have shown that mothers who have a higher level of education tend to have fewer children. As higher level of education increases wages, meaning the opportunity cost of fertility also increases. In addition, as the period of education increases, it delays the age of marriage and birth, resulting in shorter childbearing periods. Therefore, the mothers' level of education can affect to low fertility rate(Lee Seok-hwan, 2014:25).

2.3.2.3. The existence of grandparents in household

According to the research of Min Hee-chul (2008:51), in the context of Korea, the presence of grandparents within a household can be a crucial factor in parents' birth decision. If grandparents live within the household, they can give physical help to take care of their grandchildren and reduce the childcare burden. As a result, it might have a positive result on parents' birth decision.

2.4. Birth interval as measurement of fertility outcome

The total fertility rate (TFR) is the most common index of fertility. **[Table 1]** shows that most empirical studies of childbirth grants have used total fertility rate as a dependent variable.

The total fertility rate is the sum of the age-specific fertility rates. For example, to get the fertility of women aged 30, the number of new babies born to women aged 30 is divided by the number of all 30-year-old women. In the same way, we can obtain each age-specific fertility rate.

Even though the TFR is an adequate indicator for estimating current fertility status, it is difficult to get an actual completed family size throughout life. In other words, the total fertility rate cannot forecast how many births currently childbearing women will eventually have in total.

The birth interval can make up for this weakness of TFR. As women get older, age-specific fertility rate might change. The birth interval can predict the total number of children that women can give birth to during their lifetime while reflecting changes. With a reduced birth interval, women may have more births within their childbearing period of 15–49 years old.

2.5. Theoretical framework for this study

Based on the literature reviews conducted above, the considerations for the range of studies, variables, and methodologies of this study as follows.

Before 2012, researches covered specific areas such as Seoul (Seok Ho-won, 2011; Hong So-Jeong, 2011), the Chungchung-nam Province (Shin and Bang, 2008). After 2012, several kinds of research targeted all local governments (Park and Song, 2014; Lee Seok-hwan, 2014; Lee Myeong-seok et al, 2012; Lee and Shin, 2013). This study accessed for 165 regions, which represents 72% of the 230 local governments.

In fact, childbirth grant policies started in 2002, when a few local governments implemented this policy. The policy spread across the nation after 2006[6], and empirical research projects covering all local governments started around from 2006 (Park and Song, 2014; Lee Myeong-seok et al, 2012). This study's scope covers the period 2006–2012, because the latest version of the accessible KLIPS data published for the general public is 2012.

There have been many Korean panel studies investigating fertility trends such as KLIPS, PSKC[7], and KLoWF.[8] Even though PSKC and KLoWF have the strength to analyze fertility data, only four years of data are accessible since 2008. Using KLIPS data, which has the longest history panel data in Korea, means that data from 2006, when the childbirth grant policy had begun in earnest, can be analyzed.

The total amount of childbirth grants awarded by local governments was mainly used as the key variable (Park and Song, 2014; Lee Seok-hwan, 2014; Lee Myeong-seok et al., 2012; Lee and Shin, 2013). Some studies divide the childbirth grant into a Metropolitan level group

[6] Lee Jung-Chul(2012:58) showed the introduction of childbirth grants of local government skyrocketed when five years after first introduction of the policy 2002.

[7] Panel Study on Korean Children(PSKC), following babies born in 2008, complied by Korea Institute of Child Care and Education, the nation's think tank for early childhood policy studies.

[8] Korea Longitudinal Survey of Women and Families(KLoWF), setting fertility data from 2008, compiled by Korea Women's Development Institute, the nation's think tank for women's policy studies.

and a City, District, Borough level group (Lee Myeong-seok et al., 2012) or existence of childbirth grant dummy(Lee Seok-hwan, 2013). This study carries out its investigation using the total amount of childbirth grant (calculated at the Metropolitan level and the City, District, Borough) for convenience.

Besides, some variables are chosen to study the other factors that can affect fertility; according to advanced research, there are economic factors and socio-geographic factors. Concerning economic factor variables, GRDP per capita (Park and Song, 2014), the rate of legally permitted total ground area (Lee Seok-hwan, 2014), the rate of female and young male labor force participation (Lee and Shin, 2013) were used.

The variables of socio-geographic factors are as follows: The marriage rate and the divorce rate (Park and Song, 2014; Lee Seok-hwan, 2014; Lee Myeong-seok et al., 2012; Lee and Shin, 2013), the age at first marriage (Park and song, 2014) and the number of childbearing-age women (Park and Song, 2014).

This study replaced some variables while reflecting variables used in advanced research. For example, "the wages of mothers" and a "non-housewife income variable" are substituted for "GRDP per capita" and "the rate of legally permitted total ground area." To describe financial status, micro-level fertility studies widely use the wages of mothers and the non-housewife income variable.

Even though many types of research use the monthly wage of their spouse (Heckman and Walker, 1990; Min Hee-chul, 2008; Kim Jungho, 2009), this study utilized non-housewife income. Non-housewife income can be calculated by the total revenue of the household minus the mother's wage. As the expected result of the non-housewife income is the same as the spouse income variable: As non-housewife income within a household is higher, the expected result is that mothers will give birth more often. In addition, this study used the actual mothers' labor force participation status, rather than the total rate of women's labor force participation.

As this study already targeted married women as study objects, there is no necessity to consider the marriage rate, divorce rate, and the number of childbearing age women as advanced literature. Besides this, the study added mothers' age at marriage as an advanced research had covered.

According to the literature review, the following **[Table2]** presents the expected effects of each variable on fertility**.**

[Table 2] The expected fertility outcome of each variables

Variables		Expected fertility outcome
Economic factors	The weekly wage of women	(-)
	The monthly non-housewife income	(+)
	Labor force participation of mothers	(-)/(+)
Socio-demographic factors	The age at marriage	(-)
	The mothers' level of education	(-)
	The existence of grandparents in household	(+)
	The number of child at the time of previous birth	(-)
Policy factor	The amount of the childbirth grant	(-)/(+)

Regarding dependent variables, most macro data research projects used ″birth rate″ collected by national statistics (Park and Song, 2014; Lee Seok-hwan, 2014; Lee Myeong-seok et al., 2012; Lee and Shin, 2013) and Song and Kim (2013) used the next birth intention as a dependent variable. This study uses actual fertility data, and the birth interval as a measurement of fertility outcomes to determine the tendency of how many children a woman can give birth to during her lifetime.

Advanced research studies have used various methodologies such as probit analysis (Song and Kim, 2013), regression analysis (Lee Seok-hwan, 2014: Lee and Shin, 2013); panel fixed model analysis (Lee Seok-hwan, 2014; Lee Myeong-seok et al., 2012), and difference-in-difference (Hong So-jeong, 2008). This study used duration analysis to investigate reflecting the characteristic of a dependent variable as birth interval.

In sum, theoretical frameworks to compensate for existing relative researches and to find out the reliable result are as follows. First, to investigate space variation, this study covered the childbirth grant policy of the 165 local governments, which is the maximum number of accessible data within KLIPS. Second, to study time variation, this study covered the years from 2006 when the childbirth grant policy began in earnest, to 2012 the most recent accessible year of the KLIPS data. Third, this study used micro panel data to reflect the characteristics of individuals who make fertility decisions. Fourth, as a dependent variable, the birth interval is used rather than the birth rate, to determine the tendency of how many children a woman can give birth to during her lifetime.

III. Data and Methodology

3.1. Research subject

This study derived the data from KLIPS 9th (2006) to 15th (2012), which are the years that the childbirth grant policy began in earnest, even though the childbirth grant policy actually started in the early 2000's.

The process of deriving data in this study is as follows:

At first, by using the birth year data, it is possible to extract data about babies born in 2006–2012. By using household data, this study can get the samples of mothers and households, including regional data about where they currently live, the presence of grandparents within their household, the non-housewife income of the household, the age and education level of mothers, and the number of children in each household at previous birth years.

By merging individual data with household data, mothers' working status, this study extracted labor force participation, job status (regular/temporary), weekly wage, and the age at marriage. Due to the importance of mothers for babies, samples were excluded if there were no mother as a family member.

3.2. Duration analysis as methodology

3.2.1. Introduction of duration analysis

In this paper, duration analysis has been conducted using the STATA 13.0 program. Duration analysis is a "statistical analysis method to analyze or explain event occurrence," also known as "Survival analysis." Originated from biostatistics, duration analysis has become widely used in various fields such as sociology, medicine, and economics. Duration analysis can answer questions such as “Does smoking decrease lifespan?” “How much time do individuals spend unemployed?” “How long does it take to be arrested after incarceration?” (Matter, 2012).

In economics, some variables are in the form of the time elapsed until the occurrence of some event. Areas of application are the duration of marriages, birth space, time to the adoption of new technologies, and the time between trades in financial markets (Kiefer, 1988:648).

3.2.2. Features of duration data

3.2.2.1. Sampling

Data used for duration analysis are a sample of individual data with (1) the indicator of whether the event of interest has taken place, (2) information on the beginning of the exposure time and the time of the event, or the duration until the event (3) variables related to the probability of the event taking place and the timing of the event.

This study will examine the event of the next birth. The duration is the time between the previous birth (base time) and the next birth (specific event occurrence).

3.2.2.2. Censoring

In duration analysis, data is an incomplete observation. Consider an event such as the next birth among mothers who have already given birth previous during 2006–2012. There are probably many mothers who have not experienced their next birth before the time of the survey. It is likely that many of them will give birth again sometime in the future, but no one knows exactly when this will happen. For such a reason, it is hard to collect complete data of the next birth. This is a crucial characteristic of the duration data: “Censored” observation.

Censoring is when the relevant event had not yet occurred at the time of observation, so the total length of time between entry into and exit from the state is unknown. Given entry at time 0 and observation at time t, we only know that the completed spell is of length T > t. (Jenkins, 2005:4).

3.2.2.3. Why is duration analysis used?

Due to the censoring characteristics of duration data, there are problems with using the Ordinary Least Squares (OLS) regression of survival times or binary dependent variable regression models (i.e. logit, probit): (1) Due to it is hard to interpret censoring, OLS mis-measure the dependent variable, (2) It is not easy to treat time-varying variables (Jenkins, 2005:10).

Regarding the OLS model, if censored observations are treated as event occurrences, this may produce a disproportionately high number of events. However, as in a case of excluding censored observations, too many observations will be found within a short period of time. This leads to different slope OLS line (Jenkins, 2005; Matter, 2012:6).

As a binary dependent variable regression model cannot explain the differences of duration, it is hard to interpret when the event occurs. (Jenkins, 2005:9–10; Matter, 2012:6) For such a reason, information about whether each individual has experienced the event is required. Censored observations are included to determine the durations before the time of censoring. Without censored cases, the result will be biased toward those with early experiences of the event.

3.2.3. Analysis of duration data

In duration analysis, the main concern is on the survivor function, S(*t*). This is the probability that an event occurs after time *t*.

$$\mathbf{S}(t) = \mathbf{Pr}\ (\mathbf{T} > t) \tag{3.1}$$

S(*t*) is the probability that an individual will not experience the event until time *t*.

3.2.3.1. The Kaplan-Meier estimate of the survivor function

Researchers use the Kaplan-Meier estimator (1958) to estimate the survivor function. The smallest time units are used as intervals to estimate the survival function.

In this study, by using the Kaplan-Meier survivor estimate method, calculation of the probability giving next birth is as follows:

First, calculate the hazard rate for each month: $\frac{d_{(k)}}{n_{(k)}}$, In this case, $y_{(k)}$is the survival time with the *k*(*k*=1.2……)th observed event measured in a month. $d_{(k)}$is the number of mothers whose next birth is within the survival time $y_{(k)}$. In addition, $n_{(k)}$ is the number of mothers whose next birth is not within the survival time $y_{(k)}$.

After that, compute the survival function $\hat{S}(t)$ as:

$$\hat{S}(t) = \prod_{k:y(k)\le t}\{1 - \frac{d_{(k)}}{n_{(k)}}\} \tag{3.2}$$

3.2.3.2. The proportional Cox hazard model

To find out whether the effect of the key variable childbirth grant and other control variables on survival time is statistically significant, this study used the proportional hazard model of the Cox (1972) estimate. The Cox proportional hazard model can estimate the effects of covariates on survival.

In the Cox method, the dependent variable is the hazard function $\lambda(t : x)$. In this case, $\lambda(t : x)$ is the relationship between covariates and the ratio of mothers who give birth again.

The hazard function is composed of $\lambda_0(t)$ and $\exp(x^{\mathrm{T}}\beta)$. It can be formulated as follows:

$$\lambda(t : x) = \lambda_0(t) \exp(x^{\mathrm{T}}\beta) \tag{3.3}$$

- $\lambda_0(t)$ stands for the hazard function when all covariates are equal to zero, which is hard to estimate due to its non-parametric characteristic.
- Researchers can estimate $\exp(x^{\mathrm{T}}\beta)$, which is the function of covariates[9], due to their parametric characteristic.

For such a reason, the Cox proportional hazard model can be called as a "semi-parametric model." The primary concern is the coefficient β corresponding to each independent variable x. This can help estimate the influences of hazard prediction factors regardless of $\lambda_0(t)$.

[9] The formula (3.3) can be re-written as $\lambda(t : x)/ \lambda_0(t) = \exp(x^{\mathrm{T}}\beta)$. When a covariate changes by one unit, the ratio of $\lambda(t : x)/ \lambda_0(t)$ can be multiplied by $\exp(\beta)$, which is called as hazard ratio.

3.3. Sampling birth interval as dependent variable

Time and event variables are necessary to conduct duration analysis, using the birth interval as a time variable requires extracting the data of birth. For example, if the first child was born in January 2008 and the next was born in September 2010, the coded time variable would be 33 months.

As for the event variable, if there is a next born child, the event can be considered to have happened. In other words, the event variable can be coded as 1 if there is an event, which means there is a next baby born, and it can be coded as 0 if there was no event within the period of observation. Observations discretionally finished at September 2012 when the 15th KLIPS survey finished.

3.4. Childbirth grant as key variable

To create the childbirth grant variable, an official document was sent through a public website called “Request of information disclosure (http://www.open.go.kr)” to 230 public employees who are currently in charge of the childbirth grant policy. The childbirth grant data includes information about amount of money a mother can receive by birth order from the first to fifth born, years of 2006–2012. Similar to the study of Park and Song (2014), this study excluded in-kind support (i.e. baby products and vouchers) and narrowed down to ranges within financial support.

Using residential codes in household data allows us to determine information about the residence in which mothers and children are currently living. This data can be substituted as the value of the corresponding childbirth grant.

For example, if a mother has a second child in 2006 living in Gwang-yang city, Jeolla-nam Province, she comes to know information about the amount of money she can get if she would have a third child. Gwang-yang city will give her one million KRW, whereas Jeolla-nam Province would provide 0.3 million KRW for a third child at the time of 2006. In summary, the total birth grant would be 1.3 million KRW.

There are hypotheses behind this logic; assuming that mothers are well aware of their own local government childbirth grant policy (i.e. The total amount of money by birth order, conditions to receive money).

In addition, there is assumption that all mothers would meet the recipient qualifications at the time of their next birth. In general, the local government may not offer a grant depending on the mothers' residence period. Even though this period differs from region to region; in general, mothers should live in the same area for at least six months to one year.

IV. Empirical findings

This chapter will describe the general characteristics of research objects. After that, the results of research testing and the factors affecting fertility will be described.

4.1. Descriptive statistics

[Table 3] presents the characteristics of 978 households and mothers who have had at least one baby from 2006 to 2012.

As for economic factors, 70.5% of mothers are in the labor force, which means that 29.5% are not in the labor force. The average weekly wages of mothers are 344 thousand KRW, the minimum value was 7.8 thousand KRW below the average, and the maximum was 2.69 million KRW above. The weekly wages of mothers who are not currently in the labor force was estimated using a Heckman two-step estimation model (Heckman, 1976)[10]. The estimated wages of mothers are presented in **[Appendix A].**

Non-housewife income (monthly) was 2.17 million KRW on average, which was calculated by taking the monthly wage of mothers from the total household income. The average total income (yearly) of a household was 42.55 million KRW.

The average marriage age of mothers is 28.5 (The standard deviation is 3.45), 66.9% (657) of mothers married when they were 10–20. 32.0% (313) of mothers married in their 30's.

Regarding the mothers' level of education, 33.8% (331) were below high school graduate level, 33.2% (325) were at the undergraduate level, 28.8% (281) were college graduates, and

[10] The model is to estimate female labor supply and wages. Factors to determine the wages are the level of education, age, and age squared. The model used in this case is as follows:

$$wage = \beta_0 + \beta_1\, educ + \beta_2\, age + \beta_3 age^2 + u_1$$

The model can get wages using a married dummy, the number of children in the household, the level of education, and the age and the age square data:

$$\gamma_0 + \gamma_1\, married + \gamma_2\, children + \gamma_3 educ + \gamma_4 age + \gamma_5 age^2 + u_2 > 0$$

4.3% (43) of mothers were graduate school graduates.

[Table 3] Descriptive Statistics

Variable	Category	Frequency
Labor force participation of mothers	**0: Not in the Labor Force**	690(70.5%)
	1: in the Labor Force	288(29.5%)
	Total	978(100.0%)
The wage of women (Weekly)	**Average (n=978)**	344 thousand KRW
	Min	-7.8 thousand KRW
	Max	2,692 thousand KRW
The non-housewife income (Monthly)	**Average (n=978)**	2.17 million KRW
Total household income (Yearly)	**Average (n=978)**	42.55 million KRW
The age at marriage	**10-20's**	657(67.2%)
	30's	313(32.0%)
	40's	8(0.8%)
	total	978(100.0%)
The mothers' level of education	**1: high school graduate**	331(33.8%)
	2: College graduate	281(28.8%)
	3: University graduate	325(33.2%)
	4: Graduate school	41(4.3%)
	total	978(100.0%)
The existence of grandparents in household	**0: No**	931(95.2%)
	1: Yes	47(4.8%)
	total	978(100.0%)
The childbirth grants	**Average (n=978)**	816 thousand KRW
	0: No exist	289(29.5%)
	1: Exist	689(70.5%)
	total	978(100.0%)
The number of children (At the time of previous of birth)	**1**	448(45.8%)
	2	424(43.3%)
	3	99(10.1%)
	4	6(0.6%)
	5	1(0.1%)
	total	978(100.0%)

In addition, just 4.8% of households lived with their grandparents. Most households had just one or two children, at 45.8% and 43.3%.

The expected childbirth grant is an average of 816 thousand KRW. 70.5% of mothers currently live in a region where childbirth grant would be given for their next birth. However, some parents live in areas where there would be no childbirth grant for their next child (29.5%).

4.2. The birth interval trend

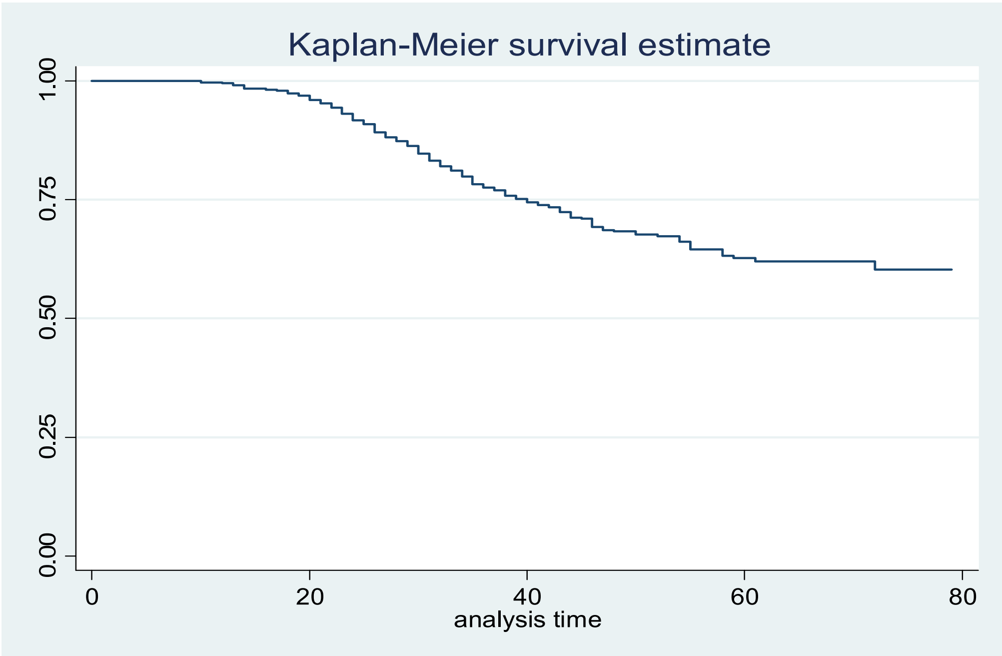
The necessary period for mothers who have babies born in 2006–2012 gives the next birth and the frequency of next birth is shown in **[Table 4]**. As a result of duration analysis, mothers next give birth within an average of 33.3 months. Approximately 80% of mothers did not a give birth again until September 2012.

[Table 4] The average survival time from previous birth to next birth and the frequency of next birth

	Average	
Survival time	33.30 months	
	Observation	**Percent**
Censored(don't have next birth)	783	80.06
Event (have next birth)	195	19.94
Total	978	100.00

Below **[Graph 1]** shows the Kaplan-Meier survival estimate for the next birth as time passes by month. In duration analysis, the system continues to track until the mothers next give birth, the final observation point is the time of the next birth. It is dealt with right-censored if the next birth does not occur until September 2012. At the start (the time of the previous birth), the overall survival rate equals 1 (100%). As time goes by, the next birth (event) happens, and failures occur. If the slope is gradual, it means the next birth happens less often.

The base time is when mothers give birth; the survival ratio starts from 100% (1.00) when parents have not yet had another child. The survival rate goes down by the next birth occurrence. You can find more detail on the tendency of **[Graph 1]** in **[Table 5]**. It appears that most next birth events happened at 20–50 months. After four years, the survival ratio seems to stabilize. This indicates that mothers decide their life time fertility intention within around 33.3 months (2.9 years).



[Graph 1] The Kaplan-Meier survival estimate of birth interval

[Table 5] The list of survival estimate

Time (Month)	Beg. Total	Fail	Net Lost	Survivor Function	Std. Error	[95% Conf. Int.]	
3	978	0	2	1.0000	.	.	
4	976	0	3	1.0000	.	.	
5	973	0	7	1.0000	.	.	
6	966	0	10	1.0000	.	.	
7	956	0	12	1.0000	.	.	
8	944	0	11	1.0000	.	.	
9	933	0	18	1.0000	.	.	
10	915	3	19	0.9967	0.0019	0.9899	0.9989
11	893	0	18	0.9967	0.0019	0.9899	0.9989

Time (Month)	Beg. Total	Fail	Net Lost	Survivor Function	Std. Error	[95% Conf. Int.]	
12	875	1	22	0.9956	0.0022	0.9883	0.9983
13	852	4	5	0.9909	0.0032	0.9819	0.9954
14	843	6	17	0.9839	0.0043	0.9729	0.9904
15	820	0	17	0.9839	0.0043	0.9729	0.9904
16	803	2	8	0.9814	0.0046	0.9698	0.9886
17	793	2	16	0.9789	0.0049	0.9668	0.9867
18	775	4	14	0.9739	0.0055	0.9606	0.9827
19	757	4	17	0.9687	0.0060	0.9544	0.9786
20	736	7	9	0.9595	0.0069	0.9435	0.9711
21	720	5	11	0.9529	0.0075	0.9357	0.9655
22	704	7	10	0.9434	0.0082	0.9248	0.9575
23	687	9	16	0.9310	0.0091	0.9108	0.9468
24	662	10	26	0.9170	0.0100	0.8950	0.9345
25	626	5	19	0.9096	0.0104	0.8869	0.9280
26	602	12	24	0.8915	0.0115	0.8667	0.9119
27	566	6	30	0.8821	0.0120	0.8563	0.9034
28	530	5	22	0.8737	0.0124	0.8471	0.8960
29	503	6	19	0.8633	0.0130	0.8356	0.8867
30	478	9	9	0.8471	0.0138	0.8177	0.8721
31	460	8	13	0.8323	0.0145	0.8016	0.8587
32	439	6	12	0.8209	0.0151	0.7892	0.8484
33	421	5	19	0.8112	0.0155	0.7786	0.8395
34	397	6	7	0.7989	0.0160	0.7653	0.8283
35	384	8	5	0.7823	0.0168	0.7473	0.8131
36	371	3	14	0.7760	0.0170	0.7405	0.8073
37	354	3	8	0.7694	0.0173	0.7334	0.8012
38	343	5	12	0.7582	0.0177	0.7213	0.7909
39	326	3	9	0.7512	0.0180	0.7137	0.7845
40	314	3	11	0.7440	0.0183	0.7060	0.7779
41	300	2	11	0.7391	0.0185	0.7006	0.7734
42	287	2	8	0.7339	0.0188	0.6950	0.7687
43	277	4	5	0.7233	0.0192	0.6835	0.7590
44	268	4	6	0.7125	0.0197	0.6719	0.7491
45	258	1	12	0.7098	0.0198	0.6689	0.7466
46	245	6	10	0.6924	0.0206	0.6501	0.7306
47	229	2	3	0.6863	0.0208	0.6435	0.7251
48	224	1	8	0.6833	0.0209	0.6402	0.7223
49	215	0	5	0.6833	0.0209	0.6402	0.7223
50	210	2	7	0.6768	0.0212	0.6331	0.7164
51	201	0	10	0.6768	0.0212	0.6331	0.7164
52	191	1	8	0.6732	0.0214	0.6292	0.7132
53	182	0	7	0.6732	0.0214	0.6292	0.7132
54	175	3	5	0.6617	0.0221	0.6164	0.7029
55	167	4	7	0.6458	0.0229	0.5989	0.6887
56	156	0	11	0.6458	0.0229	0.5989	0.6887
57	145	0	7	0.6458	0.0229	0.5989	0.6887

Time (Month)	Beg. Total	Fail	Net Lost	Survivor Function	Std. Error	[95% Conf. Int.]	
58	138	3	10	0.6318	0.0238	0.5831	0.6764
59	125	1	8	0.6267	0.0242	0.5774	0.6720
60	116	0	12	0.6267	0.0242	0.5774	0.6720
61	104	1	6	0.6207	0.0247	0.5704	0.6669
62	97	0	8	0.6207	0.0247	0.5704	0.6669
63	89	0	7	0.6207	0.0247	0.5704	0.6669
64	82	0	8	0.6207	0.0247	0.5704	0.6669
65	74	0	10	0.6207	0.0247	0.5704	0.6669
66	64	0	13	0.6207	0.0247	0.5704	0.6669
67	51	0	4	0.6207	0.0247	0.5704	0.6669
68	47	0	1	0.6207	0.0247	0.5704	0.6669
70	46	0	2	0.6207	0.0247	0.5704	0.6669
71	44	0	10	0.6207	0.0247	0.5704	0.6669
72	34	1	10	0.6024	0.0299	0.5411	0.6583
73	23	0	8	0.6024	0.0299	0.5411	0.6583
74	15	0	6	0.6024	0.0299	0.5411	0.6583
75	9	0	3	0.6024	0.0299	0.5411	0.6583
76	6	0	4	0.6024	0.0299	0.5411	0.6583
78	2	0	1	0.6024	0.0299	0.5411	0.6583
79	1	0	1	0.6024	0.0299	0.5411	0.6583

4.3. The factors affect on birth interval

[Table 6] indicates the results of the Cox proportional hazard model. It shows the influences of economic factors (weekly wage of mothers, total household income, and mothers' labor force participation), socio-demographic factors (The age at marriage, the level of education, and the presence of grandparents within a household) and policy factors (childbirth grant) on the birth interval.

The coefficient of the Cox proportional hazard model can be interpreted as follows: If the coefficient is bigger than 1, this independent variable reduces the birth interval and has a positive impact on the fertility rate. Meanwhile, if the coefficient is less than 1, this independent variable may increase the birth interval and can be recognized as an adverse effect on the fertility rate.

[Table 6] The results of Cox proportional hazard model (n=978)

variable		Coefficient (Standard error)	P > |z|
Economic factors	The wage of women (Weekly)	0.9905177* (0.0054715)	0.085
	The non-housewife income (Yearly)	1.000017 (0.0000207)	0.400
	Labor force participation of mothers	1.378773* (0.235879)	0.060
Socio-demographic factors	The age at marriage	0.9601644* (0.0223432)	0.081
	The mothers' level of education	1.004758 (0.392638)	0.903
	The existence of grandparent in household	0.8647077 (0.3357571)	0.709
	The number of child	0.2273327*** (0.0400212)	0.000
Policy factor	The amount of childbirth grants	1.000841 (0.0009536)	0.378
LR chi2(8)		126.00	
Prob > chi2		0.000	
Log likelihood		-1131.5884	

Note: **p* <0.1, ***p*<0.05, ****p*<0.01

4.3.1. The wage rate of women and non-housewife income

About the weekly wage of mothers, holding the other covariates constant, the weekly wage of mothers reduces the monthly hazard of giving birth by -0.9% (0.09905177-1= -0.90094823). As the coefficient of the variable is below one (around **0.9905177**), this indicates that a higher wage delays the next birth. It demonstrates a similar result to research conducted by Heckman and Walker (1990) Min Hee-chul (2008), and Kim Jungho (2009). According to the advanced research, the higher the wages considered, the greater the opportunity cost childbearing has for women.

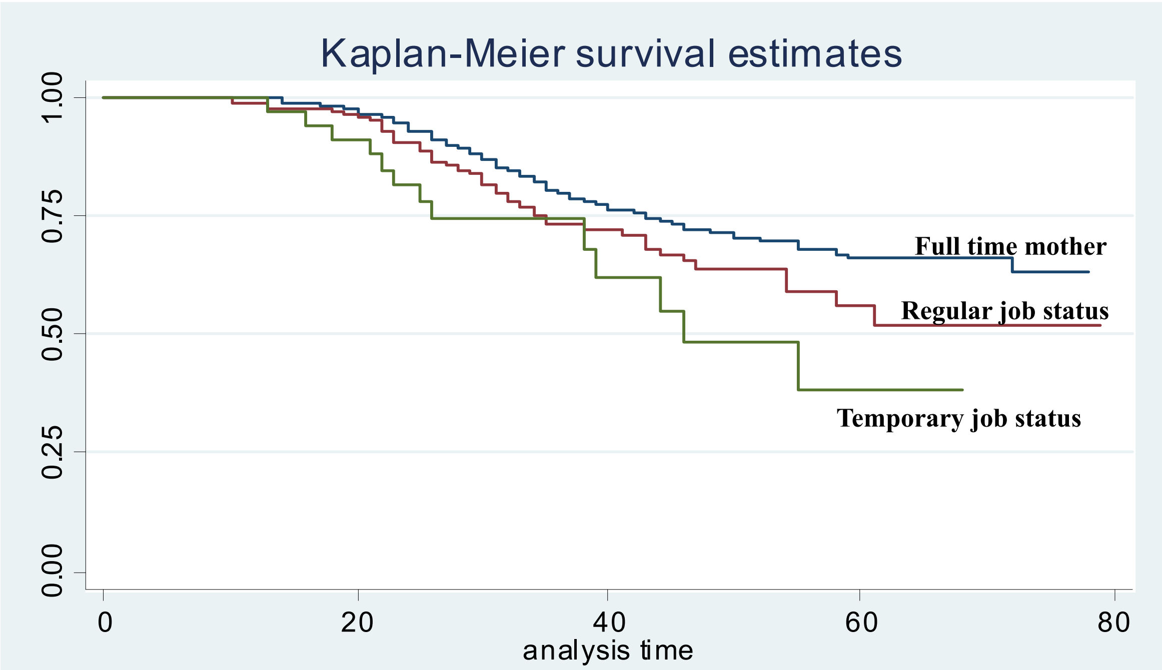
In this study, non-housewife income (monthly) was chosen as a substitute for spousal income. The hypothesis behind this logic is that if there is plenty of money in the household, mothers tend to have more children due to there being less of a financial burden in caring for their children. It can be expected to show a similar result to the spouse income variable that most advanced research has used.

The coefficient of non-housewife income is above one; this means that the marginal unit of increasing total revenue reduces the birth interval, which has a positive effect on the fertility rate. However, the result is statistically insignificant. Advanced literature, conducted by Heckman and Walker (1990) Min Hee-chul (2008), and Kim Jungho (2009) reported similar result as this study: non-housewife income made a positive effect on the fertility rate, but the result was statistically insignificant.

4.3.2. The labor force participation of mothers

In this study, the labor force participation of mothers can affect a positive impact on reducing the birth interval, since the coefficient was above one (around 1.5002). If mothers currently work, they are likely to have children with a shorter birth interval; the result was statistically significant. Holding the other covariates constant, the labor force participation reduced the monthly hazard of next giving birth by 50% (1.5002-1= 0.5002). This can be explained by the first hypothesis of Min and Kim (2011), which where women try to lessen the birth interval to reduce the period of career discontinuation. Otherwise, as Lee and Shin (2011) stated above, the labor participation of mothers can have a positive impact on fertility as social conditions improve. It might reflect how the social situation in Korea has improved for working mothers.

In **[Graph 2]**, job status can be sorted into regular and temporary jobs. Mothers who are in temporary jobs have a lesser birth interval than mothers who are in regular jobs. This is quite different to the result of Min (2007), which showed that mothers with a regular job status who continuously work after their first birth tend to have a second child earlier. The opposite outcome of this study can be explained as mothers have to choose temporary jobs with flexible working hours for work–family compatibility.

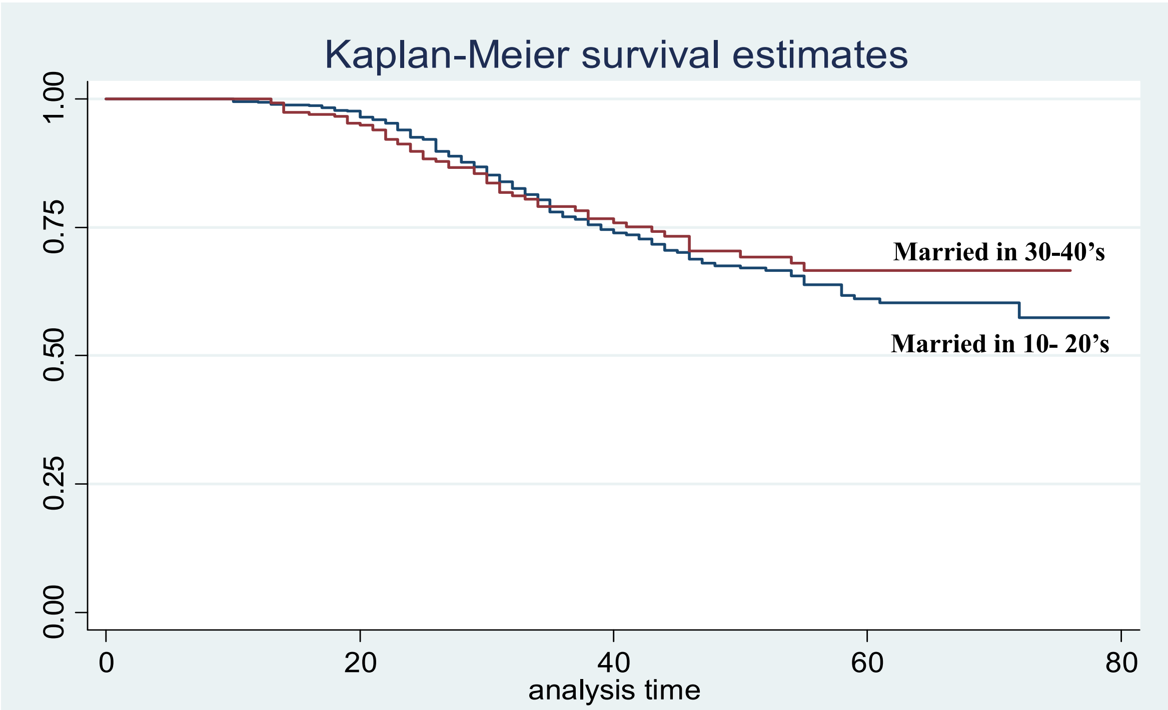


[Graph 2] The Kaplan-Meier survival estimates of mothers' job status

4.3.3. The age at marriage

In this study, the coefficient of marriage age was below one (0.9601644) at a statistically significant level. This means that the greater the marriage age of the mother, the longer the birth interval. Holding the other covariates constant, the age at marriage reduces the monthly hazard of next giving birth by -3.98% (0.9601644-1= -0.0398356). This is opposite the result of Eun (2001a, 2002b), which suggests that mothers who married before the average marriageable age have a longer birth interval than mothers who married after the average marriageable age.

However, keeping a close eye on **[Graph 3]**, the birth interval of mothers who married when they were 30–40 is slightly lower until around 35 months, even though the situation is reversed after 35 months. The opposite result in advanced research can be mainly explained as through time analysis.



[Graph 3] The Kaplan-Meier survival estimates of mothers' marriage age

4.3.4. The level of education

The coefficient of the level of education is more than one (around 1.004758); it might delay the birth interval. It is opposite result of Lee Seok-hwan (2014), for which a higher level of education raises the opportunity cost of fertility and reduces the childbearing period. However, the p-value of this coefficient is quite high (0.903, which is close to 1). It is hard to say that the level of a mother's education reduces the birth interval.

4.3.5. The presence of grandparents within a family

As to the existence of grandparents living together, the coefficient result was the opposite of advanced research. Min (2008) suggested that the presence of grandparents within a household can positively affect fertility, since grandparents may help care for the child. However, there are just 5.1% households living with a grandparent among the total households **(See Table 3)**, which could indicate a shortage of samples to analyze, creating a large standard error (0.709).

4.4. The effect of childbirth grants on birth interval

In **[table 6]**, the coefficient of childbirth grant in the Cox proportional model is more than one. Even though the coefficient of childbirth grant seems to have a positive impact on fertility, it is hard to say that there is a childbirth grant impact. As the standard error and the coefficient are quite small, the p-value of this variable is fairly high (p=0.378). As a result, it is uncertain whether increasing the marginal unit of the childbirth grant can reduce the birth interval.

Many macro-level studies have reported the positive effect of childbirth grant policy on the fertility rate (Lee Myeong-seok et al., 2012; Song and Kim, 2013; Park and Song, 2014; Lee Seok-hwan, 2014). However, this micro-level data using the study shows no statistically significant impact of childbirth grant on fertility.

4.5. Recommendations for fertility policy implications

4.5.1. Why did the increased childbirth grant not reduce the birth interval?

This study shows that the childbirth grant policy has a statistically insignificant impact on the birth interval. If parents make birth decisions considering income and child costs, they should decide to have more children when there is a marginal increase in income and a marginal decrease in prices due to the receipt of cash transfers. However, the childbirth grant represents a small proportion of childbearing costs, and it is insufficient to increase fertility. Thus, the effect is statistically insignificant.

According to Kim Eunseol et al. (2014:73-76) the “expected child cost” includes not only the childbirth cost but also “child care service tuition, childcare allowance, [and] educational spending (including cost of public institution, private tutoring, college tuition).” Potential parents care about the total expected cost when they make birth decisions. The childbirth grant is too small a part of the total expected cost to change the mindsets of parents.

Even though the childbirth grant did not reduce the child cost much, we must not jump to the conclusion of abolishing the policy. Once a country enters a low fertility trend, it is unlikely for any policy to work effectively. It will be more powerful when fertility encouragement policies conducted at both the central and local government levels are integrated to determine duplications of provisions and blind spots. The childbirth grant will serve as a part of integrated fertility encouragement policies with a reasonable sum of money.

4.5.2. Considerations for birth encouragement policy

Besides the expected childbearing cost, there are complex causes for the low fertility rate in Korea. This study shows the labor force participation of mothers and the age of marriage had a statistically significant impact on the birth interval. In other words, the labor market policies for women are closely related to increased fertility.

The labor force participation of mothers can have a positive impact on reducing the birth interval. Among mothers who are in the labor force, mothers who have temporary job status have the shortest birth intervals, as they can be more flexible in responding to work and family demands than mothers of regular job status. As most of the housework and childcare is still the responsibility of women, the current long-term work-oriented labor market conditions can make it difficult for women to determine the next birth. For married women, the fertility rate can be increased when there is the variety of flexible working time adjustment.

A lower age at marriage makes for a shorter birth interval. Recently, women are likely to be married after settling into their jobs. If young people could get jobs easily and marry young, the fertility rate could be increased. In other words, better labor market conditions for youth could increase the fertility rate.

V. Discussion and Conclusion

As local governments have competitively introduced childbirth grants to increase the total birth rate, there has been much debate on policy impact. Some research studies estimate the effectiveness of childbirth grants on the fertility rate; however, most used macro-level data that cannot cover the birth decisions of individual households. It was difficult to find studies that used micro-level data, excluding one study by Song and Kim (2013). However, its dependent variable was not actual fertility, but the intention to give birth again.

This study conducted empirical analysis to investigate the birth interval using micro panel data while taking note of the childbirth grant to minimize the debate stated above. Besides this, other factors affecting fertility were also examined for fertility encouragement policy implementation.

By using KLIPS data (9^{th}–15^{th}), this study derived data of 978 mothers of newborn babies (born 2006–2015) and household. This research apprehended the general characteristics of the sample and the trends of the birth interval through Kaplan-Meier estimation. In addition, by using the Cox proportional hazard model, economic factors (including the weekly wages of mothers, total household income, and labor force participation of mothers), socio-demographic factors (married age, education level, and the presence of grandparents), and childbirth grant policy on birth spacing were investigated.

The results of this study are as follows:

First, the birth interval from previous birth to next birth was about 33.3 months. In other words, children within a family were spaced an approximate average of 2.9 years apart.

Second, the childbirth grant had no significant impact on the birth interval. It appeared that other policy measures were necessary to increase fertility while providing temporary financial transference.

Third, the labor force participation of mothers, the weekly wage of mothers, and the age of marriage had a statistically significant impact on the birth interval. The birth interval of mothers who currently work was shorter than those of full-time mothers. Mothers who had a higher weekly wage tended to have a longer birth interval. The older the mother, the longer the birth interval. Thus, the labor market policies for women are one of fundamental issues related with low fertility problem.

Meanwhile, the limitations of this study and suggestions for follow-up studies are as follows:

First, the KLIPS data used in this study was not initially made for analyzing fertility. For studies of the birth interval, the birth order was an important issue (i.e. from marriage to the birth of the first child, and first birth to second birth). However, within the span of the analysis period (2006–2012), there was quite a small sample size of first born children. To overcome the limitation for a shift, this study included the number of children variable as a control. If there was sufficient data of firstborn child to the second, the study can extract better results.

Second, the KLIPS data survey did not include questions about whether mothers actually received the childbirth grant. This study estimated the childbirth grant variable by substituting the childbirth grant of the residence where the mothers lived at the time of their previous birth. It would be better to use the sample of mothers who actually received a childbirth grant to gain accurate results of the impact.

Last, other fertility policy variables were omitted in this estimation model such as employment system and the quality of local kindergarten and daycare facilities. Thus, there might be omitted variable biases and it can be included in the error term.

Despite its limitations, it is meaningful that this study assesses the longitudinal impact of childbirth grants on the birth interval based on micro-level KLIPS data for 2006–2012.

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APPENDIX

[Appendix A] The results of Heckman two-step selection model for the estimation of women's wage

Variables	2006		2007		2008		2009		2010		2011		2012	
	Select	wage	Select	wage	Select	wage	Select	wage	Select	wage	Select	wage	Select	wage
constant	4.6150*** (0.416291)	-73.10*** (10.63737)	-4.4734*** (0.383719)	-65.94*** (11.33585)	-4.4827*** (0.421225)	-87.869*** (12.97625)	-4.5748*** (0.386936)	-86.394*** (12.29606)	-8.1338*** (0.353473)	-85.947*** (14.5536)	-5.0852*** (0.399709)	-89.063*** (12.57732)	-5.4645*** (0.409282)	-96.370*** (13.80671)
Age (mother)	0.2900*** (0.025336)	2.4408*** (0.597956)	0.26743*** (0.023244)	2.1727*** (0.642471)	0.2564*** (0.025387)	3.5857*** (0.725953)	0.2513*** (0.023091)	3.515413 .6751521	0.4313*** (0.022468)	3.27195*** (0.774284)	0.27931*** (0.023993)	3.69289*** (0.672192)	0.30533*** (0.024426)	3.96111*** (0.725470)
Age square (mother)	-0.0037*** (0.000351)	-0.0249*** (0.008492)	-0.0033*** (0.000323)	-0.0182** (0.009097)	-0.0031*** (0.000345)	-0.0392*** (0.010206)	-0.0030*** (0.000318)	-0.0393*** (0.009378)	-0.0051*** (0.000318)	-0.0353*** (0.010592)	-0.0033*** (0.000330)	-0.0415*** (0..009243)	-0.0037*** (0.000336)	-0.0454*** (0.009942)
Years of schooling (mother)	0.0036598 (0.009411)		0.0072 (.0090995)	3.3408*** (0.242282)	0.01954** (0.009873)	-0.0392*** (0.010206)	0.0342*** (0.009211)	3.5421*** (0.269085)	0.0474*** (0.009687)	3.7263*** (0.293868)	0.03329*** (0.010129)	3.80866*** (0.278127)	0.0242** (0.103514)	3.96229*** (0.293534)
Marriage (dummy)	-0.7095*** (.0695651)		-0.7702*** (0.064075)		-0.7479*** (0.072927)		-0.7176*** (0.0636)		-1.2422*** (0.056568)		-0.6175*** (0.067857)		-0.6393*** (0.069982)	
Number of children (in House hold)	-0.2124*** (0.027003)		-0.1678*** (0.025957)		-0.1706*** (0.027585)		-0.2034*** (0.025376)		-0.1349*** (0.025239)		-0.2488*** (0.026357)		-0.2192*** (0.026378)	
Mills ratio	0.6373562 (2.47649)		2.669597 (2.48852)		2.72741 (3.027686)		-0.6703027 (2.707746)		1.505792 (2.145247)		-3.729644 (2.692735)		-1.336987 (2.935646)	
N	1,857		2,092		1,754		2,145		2,013		2,018		1,969	

Note: *p<0.1, ** p <0.05, *** p <0.01