

A study of determinants of the birthrate change in South Korea

Kyunghoon Ahn

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Martin School of Public Policy and Administration

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Advisor: Nicolai Petrovsky, PhD

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Executive Summary

South Korea has experienced a sharp demographic transition from a high birthrate of 4.5 children per woman in the 1970s to a low birthrate of around 1.19 in 2013. A low birthrate can lead to big problems for South Korean society.

In response to such a low birthrate, the South Korean government introduced policies to increase the birthrate, such as providing subsidies for daycare costs and the supply of daycare facilities. The South Korean government has spent heavily on these programs. However, the birthrate stays very low. Also, other social and economic factors could affect the birthrate.

Therefore, I studied what factors, including policies to increase the birthrate, affect the birthrate and how they affect it.

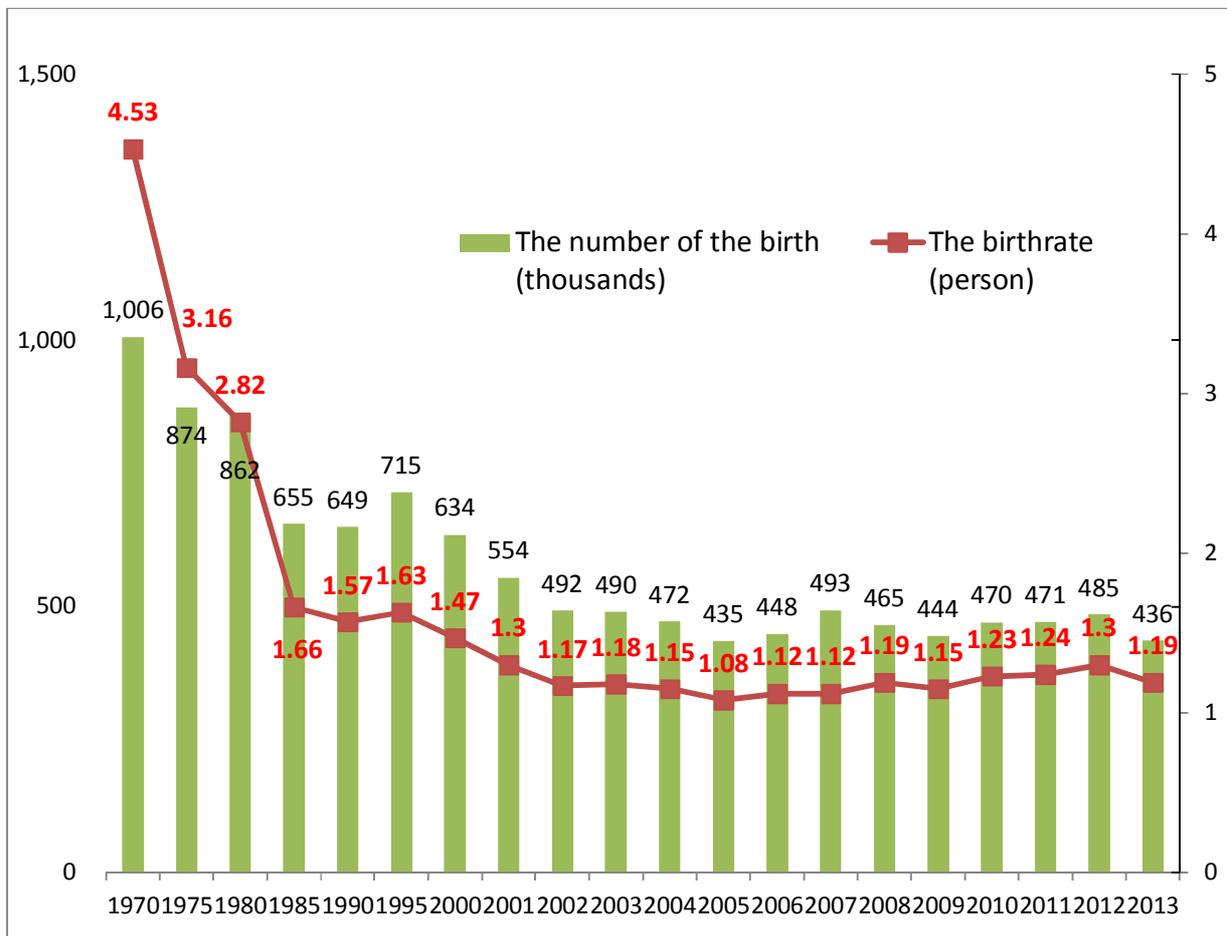
The results of the analysis show that social change is rapidly occurring, changing various aspects of family life, but the changes are closely linked to each other and child care subsidies in particular appear to have a strong effect increasing the birthrate. Female labor force participation reduces the birthrate, a result found often in economic development studies. Finally, age at first marriage reduces the birthrate.

Therefore, the South Korean government could keep policies to increase the birthrate such as subsidy for daycare cost and also find other policies to increase the birthrate efficiently such as tax penalty for single individual and policies to change the working culture.

1. Introduction

South Korea has experienced a sharp demographic transition from a high birthrate¹ of 4.5 children per woman in the 1970s to a low birthrate of around 1.19 in 2013, as seen in Figure 1.

Figure 1
The number of births and the birthrate in South Korea



* Source: Korea Statistic Service (www.kostat.go.kr)

1. The birthrate means the average number of children that would be born to a woman (age 15-49) over her lifetime if she were to survive from birth through the end of her reproductive life.

A low birthrate can lead to big problems for South Korean society. Sleebos (2003) said that a low birthrate can lead to lower economic development, total population and, in particular, the population of working age. This, in turn, will reduce the growth of real GDP relative to what it would otherwise have been. Because of the greater decline for the population of working age than for total population, income per capita will also decline, relative to what it would otherwise have been. The same applies to South Korea. A persistently low birthrate can lead to reduction of the labor force. Also, it will lead to the nation's aging society and a reduction of total output. As a result, it can hinder the sustainable economic development of nation.

In response to such a low birthrate, the South Korean government has had policies to increase the birthrate, such as a subsidy for daycare cost, supply of public daycare facilities, and tax benefits. The South Korean government has spent heavily on these programs.

Therefore, I would like to examine what factors, including policies to increase the birthrate, affect the birthrate and how they affect it. An analysis of the causes of the birthrate decreases in South Korea should take into account social and economic factors that have been demonstrated to be important in other studies.

2. Literature Review

Various factors affect the birthrate from 'age at first marriage of women²' to 'female labor market participation rate'. Also, there are many previous analyses about influences on the birthrate.

2. Age at first marriage of women means the national average age at first marriage of women.

Sleebos (2003) researched a broad set of determinants shared by most accounts of recent fertility declines in OECD (Organization for Economic Cooperation and Development) countries. These determinants (or causal factors) include: i) material and psychological benefits provided by children; ii) direct and opportunity costs of children incurred by their parents; iii) the broad economic environment in which reproductive decisions take place, as shaped by the labor market difficulties faced by youths, by changes in women's economic roles and by increased valuation of women's work; iv) individual lifestyle factors, such as greater values attached to autonomy and self-realization, greater willingness by women to adjust family aspirations to pursue career goals, and the diffusion of alternative forms of relationships; and v) societal and cultural norms, such as those determining the division of home responsibilities within families and those underpinning the functioning of the welfare and tax systems.

Cho, Nam-hoon (2008) divided factors that affect the birthrate into social and economic ones. Among social factors, daycare facilities, the divorce rate and the marriage rate can have a decisive effect on the birthrate. And among economic factors, the rate of female labor market participation and the youth unemployment rate can have a decisive effect on a birthrate.

Previous research indicates that childcare environments are closely related to the birthrate. A lack of daycare facilities has a negative effect on the birthrate (Kim, Seungkwon, 2004). Also, increases in the age at first marriage have a negative effect on the birthrate (Eun, Ki-soo, 2001). One of the proximate causes of the observed decline in the birthrates in OECD countries has been a tendency by women to postpone their decisions to have children until a later age (Sleebos, 2003). This causes a reduction of the child bearing years.

The rate of female labor market participation has a negative effect on the birthrate. Studies of the determinants of the birthrate in OECD countries often stress the existence of trade-

offs confronting individual women between having children, on one side, and taking advantage of the employment opportunities available to them, on the other. When applied across countries, the notion of a trade-off facing individual women would suggest that countries where total birthrates are lowest should also record higher employment opportunities for women (Sleeboos, 2003). On the other hand, the youth unemployment rate has a negative effect on the birthrate, because, an increase of youth unemployment rate aggravates anxiety about the future (Kim, Jong-myung, 2007).

I summarize the expected effect of factors that affect the birthrate as identified in previous studies as Table 1.

Table 1
Determinants of the birthrate

Factor	Variable	Expected effect
Social	Daycare facilities	Positive
	Divorce rate	Negative
	Age at first marriage	Negative
Economic	Female labor market participation rate	Negative
	Youth unemployment rate	Negative

The relationship between social and economic factors of previous research and the birthrate is likely to apply to South Korea.

There are other factors to also be considered in an analysis of the causes of the birthrate change in South Korea. The average working hours of women may have a negative effect on the birthrate. Women do not have enough time to care for their children if they have a job, particularly if the hours are long. It is especially difficult to do their mother's jobs in household and also work a full-time job in South Korean working culture. South Koreans are known to be among the world's worst workaholics, the average South Korean worked 2,163 hours in 2012, 1.3 times the OECD average, ranking second in the OECD in terms of working hours in 2012 (OECD, 2015). And on top of the long working hours, South Koreans often endure forced drinking sessions and work dinners under their uniquely hierarchy-driven work culture.

Also, the average income of household may have positive effect on the birthrate. If they do not have enough income for childcare, they may hesitate to give birth.

Meanwhile, in response to a low birthrate, the South Korean government has had policies to increase the birthrate, such as subsidy for daycare cost, tax credit for the birth and rearing, and supply of daycare facilities.

In this regard, previous studies found that the subsidy for daycare cost has a positive but limited effect on the birth rate. For example, D'Addio & d'Ercole (2005) and Luci & Thevenon (2011) demonstrated that when the disposable income of a household increases 10 percent through income subsidy and tax benefit, the birthrate increase 0.02 percent across OECD countries. And Laroque & Salanie (2008) said that income subsidy has a positive impact on increase of the birthrate in France.

Therefore, an analysis of the causes of the birthrate decrease in South Korea should take into account the social and economic factors that have been demonstrated to be important in other studies of the birthrate.

3. Research Design

3.1. Analysis model

I will analyze what factors affect the birthrate and how they affect it by conducting time series analysis. I will set the birthrate as the dependent variable. Social and economic variables identified by previous research will be independent variables.

And I will assume that the independent variables affect to the birthrate with a time-lag (1 year³). People decide to have a pregnancy or not if there are sufficient condition to have a pregnancy.

3.2. Data and Variables

1) Dependent variable

As the dependent variable, I will use the national birthrate. The birthrate means the average number of children that would be born to a woman (age 15~49) over her lifetime if she were to survive from birth through the end of her reproductive life.⁴

2) Independent variables

I will divide factors that affect the birthrate into two groups: social and economic factors.

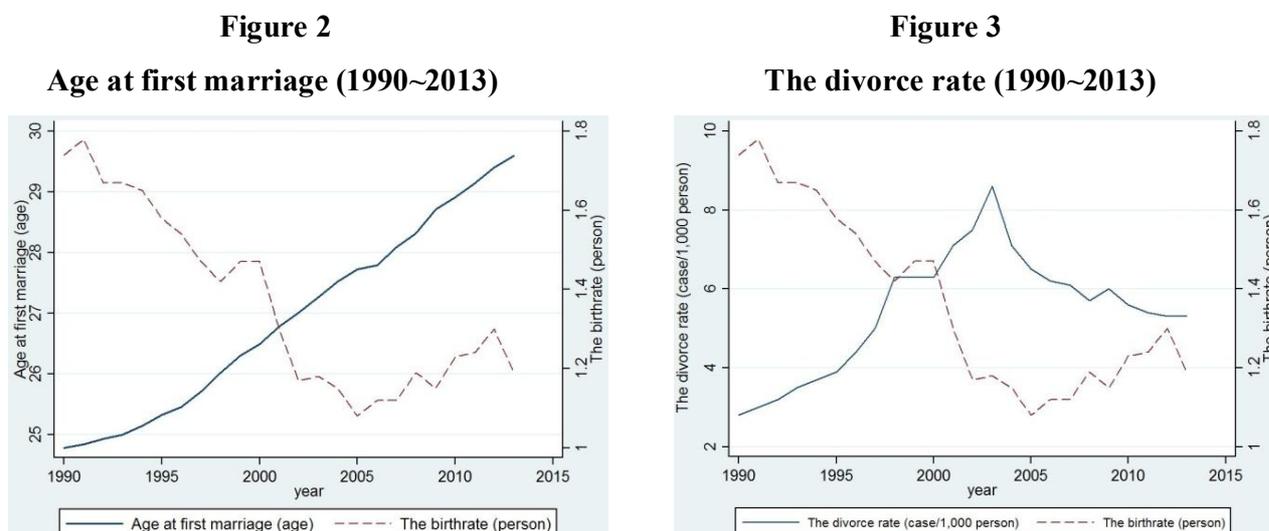
3. It takes 9 months to give birth to a child. But my data are collected annually. Therefore, I assume a time-lag of as much as 1 year.

4 . The birthrate = Sum of birthrate by age/1000 *5

Social factors

As social factors, I will consider ‘age at first marriage’, ‘the divorce rate’ and ‘the number of daycare facilities’.

‘Age at first marriage’ means the national average age at first marriage of women. It is only for women who have married at a particular point. And ‘the divorce rate’ means the national average divorce rate. It means the number of divorces per 1,000 populations (over age 15) for a year. Figures 2 and 3 present trends in age at first marriage and the divorce rate.

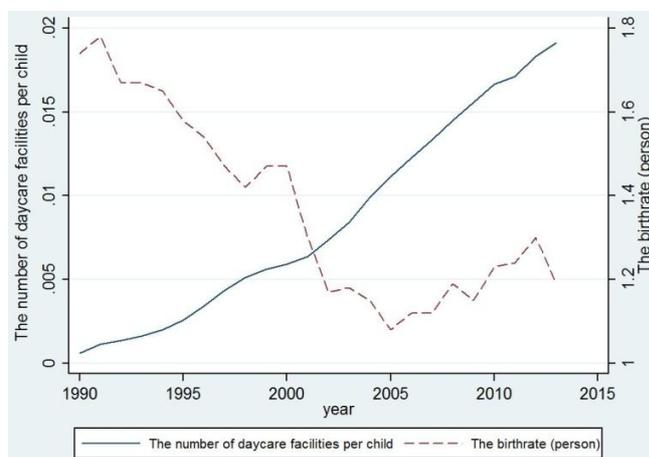


Also, ‘supply of daycare facilities’ can encourage birthrate by making it easier for mothers to work. It can be measured by the national number of daycare facilities, as seen in Figure 4, (including public, private and workplace) per child (age 1~5).

These data are provided by Korea Statistic Service⁵ from 1990 to 2013.

5. South Korea’s national statistical agency

Figure 4
The number of daycare facilities per child (1990~2013)



Economic factors

As economic factors, I will consider ‘female labor market participation rate’, ‘average working hours of women’, ‘monthly average income of household’, ‘Consumer Price Index (CPI) for rent’ and ‘subsidy for daycare cost per child’.

‘Female labor market participation rate’ and ‘average working hours of women’ mean the proportion of labor market participation and average working hours of women (age from 15 to 49) for a year. Trends in these rates can be seen in Figures 5 and 6.

Figure 5
Female labor market participation rate
(1990~2013)

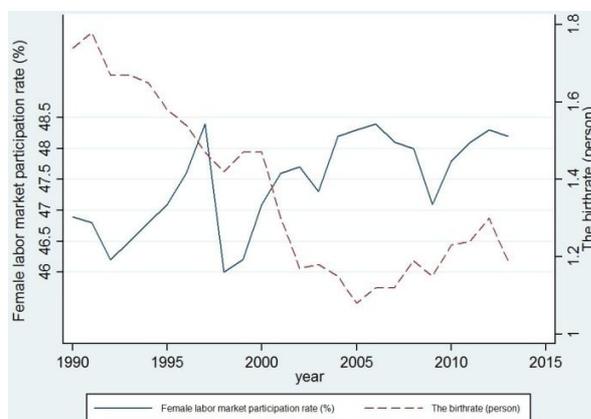
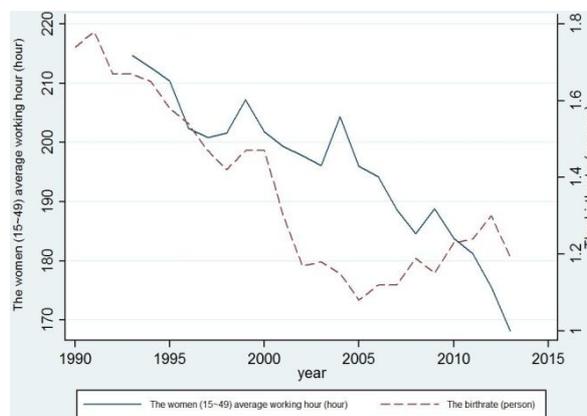


Figure 6
Average working hours of women
(1993~2013)



‘Monthly average income of household’ means national monthly average income of household. This data is provided with nominal Korean won base. In my research, I will change this nominal data to real data by using CPI index.⁶ These data are provided by Korea Statistic Service from 1990 to 2013 and the trend is evident in Figure 7.

Households of South Korean spend a large part of family budget on rent. In other words, expenditure for rent has a great effect on disposable income of household and decision for child birth. Therefore I will consider a ‘Consumer Price index (CPI, 2010=100) for rent’ as one of economic factors (see Figure 8).

6. Monthly average income of household = nominal monthly average income of household / CPI (2010=100) * 100

Figure 7
Monthly average income of household
(1990~2013)

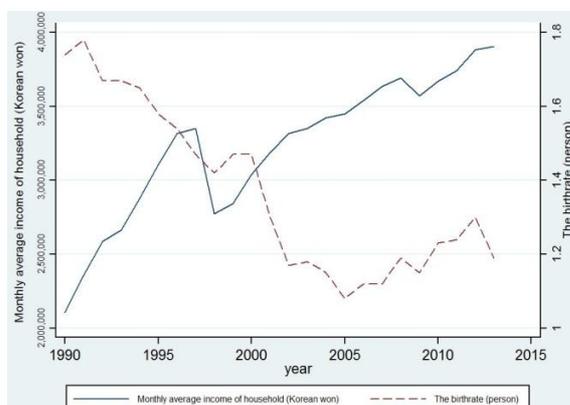
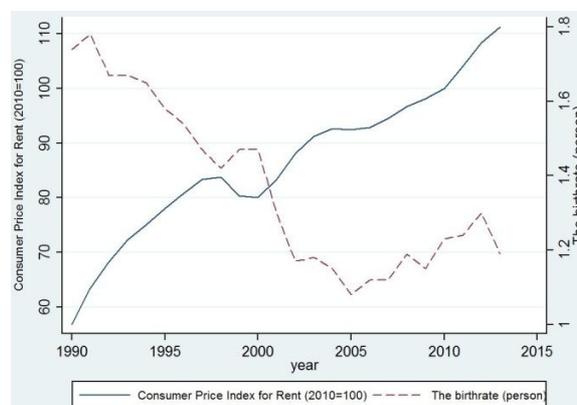


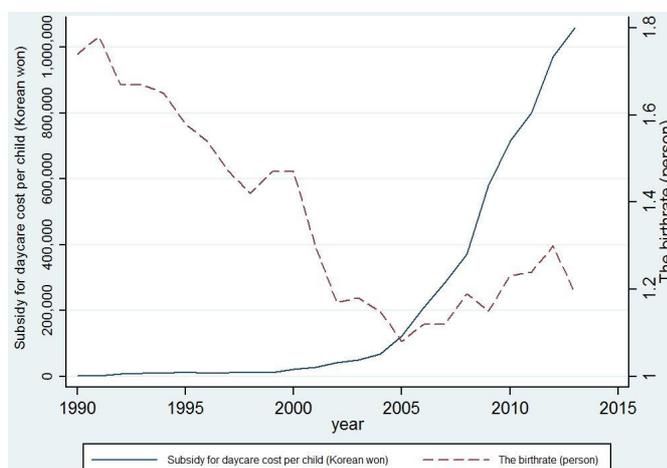
Figure 8
CPI for rent (1990~2013)



The South Korean government has policies to provide a subsidy for daycare cost and a tax credit for children to increase the birthrate. It can be measured by annual budget size for subsidy for daycare cost per child of the Ministry of Health and Welfare. These are shown with Korean won base in Figure 9. This data is provided with nominal Korean won base. In my research, I will change this nominal data to real data by using CPI index.⁷ These data are provided by the Ministry of Health and Welfare from 1990 to 2013.

7. Subsidy for daycare cost per child = annual budget size for daycare facility (nominal) / CPI (2010=100) * 100 / children (age 1~5) populations.

Figure 9
Subsidy for daycare cost per child (1990~2013)



In order to analyze the factors that affect the birthrate and how they affect the birthrate, I will consider a total of 8 independent variables (3 social variables, 5 economic variables). These data are found on the Korea Statistic Service and the Ministry of Health and Welfare website. And these data are measured every year from 1990 to 2013 (24 years)⁸.

I summarize the variables that this research will contain and source and unit of the variables as Table 2.

8. Korea Statistic Service and the Ministry of Health and Welfare provide only data of variables that I used from 1990.

Table 2
Dependent and Independent Variables

		Variable (Unit)	Source
Dependent variable (y)		<ul style="list-style-type: none"> • The birthrate (person) ☞ The average number of children that would be born to a woman (15~49) over her lifetime <li style="padding-left: 20px;">: Sum of birthrate by age X 5 ÷ 1000 	Korea Statistic Service (www.kostat.go.kr)
Independent Variable (x_n)	Social Variable	<ul style="list-style-type: none"> • Age at first marriage (age) ☞ The national average age at first marriage. It is calculated only for women who have married at a particular point • The divorce rate (case per 1,000 person) ☞ The number of divorce cases per 1,000 populations (over 15) for a year • The number of daycare facilities per child (1~5) (The number of place) ☞ The national number of daycare facilities ÷ children (1~5) population 	Korea Statistic Service (www.kostat.go.kr)
	Economic variable	<ul style="list-style-type: none"> • Female(15~49) labor market participation rate (%) • Average working hours of women (15~49) (hours) ☞ Average working hours of women for 1 year • Monthly average income of household (Korean won⁹) ☞ Nominal monthly average income of household ÷ CPI (Consumer Price Index, 2010=100) X 100 • CPI for rent ☞ CPI for rent (2010=100) 	Korea Statistic Service (www.kostat.go.kr)
		<ul style="list-style-type: none"> • Subsidy for daycare cost per child (Korean won) ☞ Annual budget size for daycare subsidy (nominal) ÷ CPI (2010=100) X 100 ÷ children (1~5) population 	Ministry of Health and Welfare (www.mw.go.kr)

6. 1 US dollar = 1,100 Korean won (approximate value, April. 2015)

4. Analysis and Findings

The primary aim of this study is to examine what factors affect the birthrate and how they affect it. To do so, I use a time series analysis model that predicts South Korean birthrates 1990-2013, annually, using ‘age at first marriage’, ‘the divorce rate’, ‘the number of day care facilities per child’, ‘female labor force participation rate’, ‘average working hours of women’, ‘monthly average income of household (in 1,000,000 Korean won)’, ‘CPI for rent’, and ‘subsidy for daycare cost per child’. And, as already stated, I assume that the independent variables affect the birthrate with a time-lag (1 year).

$$\begin{aligned}
 * \text{ Equation}^{10}: Y_{\text{birthrate}, t} = & \beta_0 + \beta_1 X_{\text{first age}, t-1} + \beta_2 X_{\text{divorce rate}, t-1} + \beta_3 X_{\text{daycare facility}, t-1} \\
 & + \beta_4 X_{\text{labormarket participation}, t-1} + \beta_5 X_{\text{working hour}, t-1} + \beta_6 X_{\text{household income}, t-1} \\
 & + \beta_7 X_{\text{rent}, t-1} + \beta_8 X_{\text{subsidy}, t-1} + \varepsilon_t
 \end{aligned}$$

The estimation is by regression, but time series issues must first be addressed.

All of the variables have time trends (unit roots) so regression might or might not be valid. Spurious correlation is possible among these increasing and decreasing variables. There is another possibility. Even though these variables are increasing or decreasing through time, they could be related to each other anyway. That is, they could be co-integrated.

To check this possibility, estimate the regression in the levels, ignoring the possible spurious correlation. Then estimate the residuals. If the residuals do not have a time trend, the data are co-integrated and have a valid relationship. That result actually occurs here. After

7. Where ‘ $Y_{\text{birthrate}, t}$ ’ is the birthrate of South Korea in year t . ‘ β_n ’ is the coefficient of each variable. ‘ $X_{\text{variable}, t-1}$ ’ is the independent variables in year $t-1$. ‘ ε_t ’ denotes the random error in the model.

estimating the regression, the residuals do not have a time trend (unit root). The Dickey-Fuller test rejects the null hypothesis of a unit root with $p < 0.0001$, as seen in Table 3.

Table 3
The Dickey-Fuller test result

	Test Statistic	P-value
Z (t)	- 7.14	< 0.0001

The regression is therefore co-integrated and valid. And the results of regression are shown in Table 4.

Looking at the results of the regression, three variables ('age at first age', 'female labor market participation rate' and 'subsidy for daycare cost per child') have a significant association with the birthrate at the 90 percent confidence level.

Firstly, age at first marriage has a negative impact on the birthrate (Coefficient = -0.27, P-value = 0.088). In other words, as the age at first marriage increases, the birthrate decreases. The estimated effect is about -0.27 per one year of age. The standard deviation of age at first marriage is about 1.59 as seen in Table 5, which would have an effect of about -0.43 on the lifetime birth rate.¹¹ Given the mean lifetime birthrate of 1.37 as reported in Table 5, -0.43 would be about 30% decreases. Because as the age at first marriage is increased, the period of child bearing year is decreased.

Secondly, the female labor market participation rate has a negative impact on increase of the birthrate (Coefficient = -0.06, P-value = 0.067). In other words, as the female labor market

11. The effect of age at first marriage on the birthrate = $\frac{\text{Coefficient} \times \text{Standard deviation}}{\text{One year of age}} = \frac{-0.27 \times 1.59}{1} = -0.43$

participation rate increases, the birthrate decreases. The estimated effect is about -0.06 per 1 percent. The standard deviation of the female labor market participation rate is about 0.76 as seen in Table 5, which would have an effect of about -0.05 on the lifetime birth rate.¹² Given the mean lifetime birthrate of 1.37 as reported in Table 5, -0.05 would be about 4% decreases. This pattern supports the idea that women do not have enough time to take care their children if they have a job.

Finally, Subsidy for daycare cost per child has a positive impact on the birthrate (Coefficient = 0.41, P-value = 0.022). In other words, daycare subsidies significantly increase the birthrate. The estimated effect is about 0.41 per 1,000,000 Korean won, which is a large amount. The standard deviation of daycare subsidies is about 337,519 Korean won as seen in Table 5, which would have an effect of about 0.14 on the lifetime birth rate.¹³ Given the mean lifetime birthrate of 1.37 as reported in Table 5, 0.14 would be about a 10% increases. Because, the subsidy for daycare cost can reduce childcare burdens of parents, and it leads to have more children. As a result, it makes a positive effect to the birthrate.

12. The effect of the female labor market participation rate on the birthrate

$$= \frac{\text{Coefficient} \times \text{Standard deviation}}{\text{Unit of labor market participation rate}} = \frac{-0.06 \times 0.76}{1} = -0.05$$

13. The effect of daycare subsidies on the birthrate = $\frac{\text{Coefficient} \times \text{Standard deviation}}{\text{Unit of daycare subsidies}} = \frac{0.41 \times 337,519}{1,000,000} = 0.14$

Table 4
Regression results

Variable	Coefficient	Std. Err.	P-value
Age at first marriage	-0.27	0.14	0.088*
The divorce rate	-0.01	0.03	0.700
The number of daycare facilities per child	33.11	36.90	0.389
Female labor market participation rate	-0.06	0.03	0.067*
Average working hours of women	< 0.01	< 0.01	0.913
Monthly average income of house hold	-0.07	0.09	0.476
CPI for rent	< 0.01	0.01	0.835
Subsidy for daycare cost per child	0.41	0.15	0.022*
Constant	11.06	3.07	0.004

* Number of obs = 20 ; F(8,11)= 191.98 ; R-squared=0.9672 ; Significance: * P-value < 0.1

Table 5
Summary statistics of variables

Variable	Mean	Std. Dev.	Min	Max
The birthrate	1.37	0.22	1.08	1.78
Age at first marriage	26.93	1.59	24.78	29.59
Female labor market participation rate	44.45	0.76	46	48.4
Subsidy for daycare cost per child	225,020	337,519	1,258	1,058,284

5. Limitations

In order to analyze the factors that affect the birthrate and how they affect the birthrate, I just considered 8 independent variables. However, other factors those I did not consider in this study can affect the birthrate.

Firstly, the change of working culture can affect the birthrate. The unique working culture, such as the long working hours and hierarchy-driven culture can make it more difficult for women to work and to have children together. Thus, if the working culture is changed, it can affect the birthrate. However, I could not find measurable data of working culture change. Therefore, I did not analyze the effect of the working culture in this study.

Secondly, tax credits for birth and rearing can affect the birthrate just like subsidy for daycare cost. However, I could not find statistical data of on the annual tax credit amount. Therefore, I did not analyze the effect of tax credits for children in this study.

Also, my analysis is made with limited data. Korea Statistic Service and the Ministry of Health and Welfare provide only data of variables that I used in this study from 1990. Therefore, I analyze the factors that affect the birthrate and how they affect the birthrate with just 24 numbers of observations of each variable. In a time series analysis, 24 numbers of observations can be not sufficient data for accurate analysis.

6. Conclusion and Recommendation

As the other developed countries, South Korea suffers from a low birthrate. Given the current trend of low birthrates, it can be a big problem to South Korea's sustainable development¹⁴.

In response to such a low birthrate, the South Korean government has had policies to increase the birthrate, such as subsidy for daycare cost and supply of daycare facilities. The South Korean government has been spending large amounts on these programs. However, the decrease trend of the birthrate is ongoing.

Also, other social and economic factors could have impacts on the birthrate.

Therefore, I examined the causes of the birthrate decreases in South Korea by performing time series analysis using data from 1990 to 2013.

According to my study, subsidy for daycare cost has a significant impact on increase of the birthrate. However, the supply of daycare facilities appeared to have no impact on the birthrate with statistical significance.

Therefore, the South Korean government should keep policies to increase the birthrate such as subsidy for daycare cost, and also find another policy to increase the birthrate efficiently.

Additionally, there are negative associations between 'the age at first marriage', 'female labor market participation rate' and the birthrate.

14. It is a particular problem because South Korea does not have a tradition of attracting and assimilating immigrants. Permanent immigrant inflows to South Korea were just 1,077 people in 2010. (United States: 1,042,625, Japan: 19,280 in 2010) [Source: International Migration Statistics (OECD), 2012 Yearbook of Immigration Statistics (Homeland Security of U.S.)]

Therefore, the South Korea government should make efforts to decrease the age at first marriage by marriage encouragement policy. For example, tax penalty for single individual can be considered.

But for the continuous economic development, it is difficult to implement policies that reduce female labor market participation for the birthrate increase. Instead of that, the South Korea government should make efforts to reduce the childcare burden of women who have a job. If the South Korea government encourage companies to follow the law regarding paternity leave and change the working culture for working mothers to care their children without much hardship, the childcare burden of women can be reduced.

Those policies can lead to increase of the birthrate. Consequently, those can be a foundation for a sustainable growth.

Acknowledgement

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Appendix

Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
The birthrate	24	1.37	0.22	1.08	1.78
Age at first marriage	24	26.93	1.59	24.78	29.59
The divorce rate	24	5.45	1.52	2.8	8.6
The number of daycare facilities per child	24	0.01	0.01	< 0.01	0.02
Female labor market participation rate	24	47.45	0.76	46	48.4
Average working hours of women	21 ¹⁵	195.72	12.18	168.2	214.7
Monthly average income of house hold	24	3,224,783	482,285	2,106,129	3,903,897
CPI for rent	24	86.48	13.69	56.82	111.23
Subsidy for daycare cost per child	24	225,020	337,519	1,258	1,058,284

15. There are three missing data (year 1990~1992). Korea Statistic Service provides only data of average working hours of women from 1993.