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The impact of expected child-rearing expenses on childbirth based on the matching of two Korean panel data

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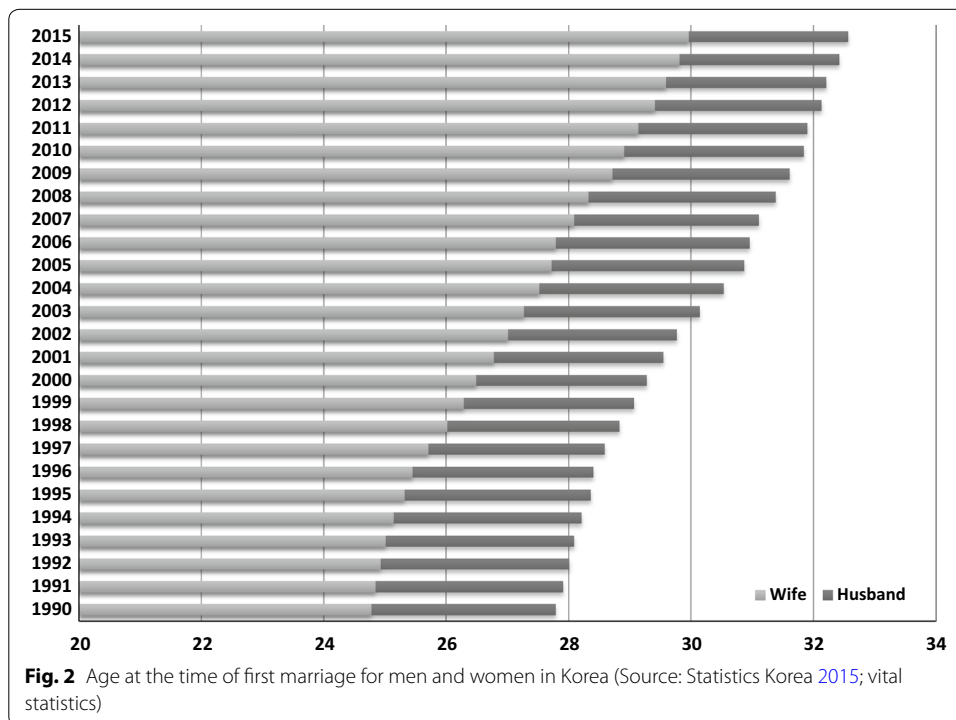
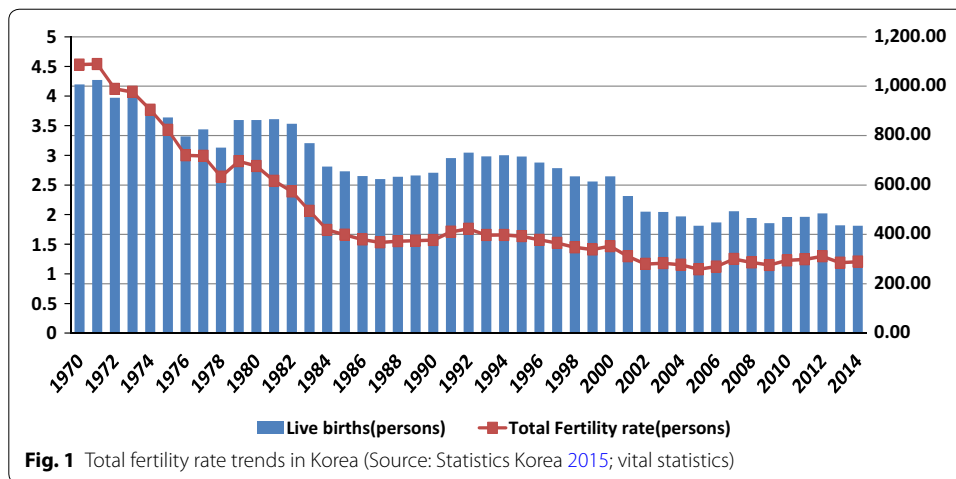
Abstract

In Korea, recent upward trends in age of marriage and downward trends in fertility rates have motivated the Korean government to provide childbirth grants and Early Childhood Education and Care (ECEC) subsidies. Through such provisions, the government hopes to lower parents' concerns regarding child-rearing expenses and to promote higher birth rates. Using combined data from the Panel Study of Korean Children (PSKC) and the Korea Longitudinal Study of Women and Families (KLoWF), this study analyzes the relationship between birth rates and anticipated child-rearing expenses. The method of kernel matching was used to combine and analyze information on children from the KLoWF and the child care environment as well as on child-rearing expenses from the PSKC. The study's findings suggest a significant but weak relationship between birth rates and the anticipated financial costs for raising a child. This relationship is more prominent in the low-education and low-income group than in economically well-situated and highly educated families. Based on the results, we suggest the following policy recommendations: firstly, further research needs to be conducted to determine the effects of governmental support on child-rearing. Secondly, customized support that considers family income and education should be provided to improve birth rates.

Keywords: Child care policy, Anticipated child-rearing expenses, Fertility rate, Korean panel, Panel matching

Background

The total fertility rate in Korea since the 2000s has remained at 1.2, which is among the lowest in industrialized countries (Fig. 1). Both men and women tend to marry at a later age (Fig. 2). The combination of low fertility rates and marriage at later stage in life represent a serious social issue for Korea. A lot of studies have been conducted to identify the underlying reasons for these two trends. Some of these studies have outlined policy recommendations to try to slow down or even reverse these problematic trends: existing studies suggest that the low birth rates in Korea are due to an increase in opportunity cost for new parents, an increase in child care expenses, and the often conflicting obligations of work and family life (owing in part to the increasing number of women obtaining a higher education degree).



The government has various policy programs such as financial support and educational support for those who raise young children. This study focuses on social policies on educational support for young children, which have been implemented throughout the country alongside various policies on fertility. In offering financial support for children’s education, the government aims to lower child-rearing expenses in order to reduce the expected costs potential parents have to take into account when thinking about family planning.

While many countries with low birth rates have similar policies, there is no consistent evidence regarding the effects of such policies. While there are a number of reasons for the lack of consistent evidence, a key problem is the limited data available for the analysis

of the effects. For potential parents, child-rearing costs are future expenses that have not been realized yet and can vary according to residential districts. Since it is challenging to assess these prospective expenses at an individual level, it is difficult to analyze relevant issues directly. Some studies that examined the effectiveness of child benefits have tried to overcome this issue, albeit limitedly, by using the differences in supports for childbirth between provinces (e.g., Choi and Song 2010). Nonetheless, these studies did not capture the prospective expenses precisely, since expected child-rearing costs can vary even among people living in the same area.

Using matched data from the Panel Study of Korean Children (PSKC) and the Korea Longitudinal Study of Women and Families (KLoWF), this study aims to overcome the difficulties previous studies faced. PSKC started in 2008 and has sufficient information on child-rearing environments and costs. While KLoWF, which commenced around the same time, lacks this information, it includes information on the childbirth trajectories of women of childbearing age. The present study combines the information on childbirth trajectories from KLoWF, with information on child-rearing expenses from PSKC, and merges the information into a single dataset using the method of kernel matching. Based on this, the authors analyze the relationship between anticipated child-rearing costs and birth rates at an individual level. Moreover, by re-evaluating conclusions and implications drawn from previous studies, we hope to contribute to the current discussion on birth rate incentives currently promoted in Korea. In the future, the authors will continue to discuss the implications of the presented study with policy makers.

This study is organized as follows. In “[Literature review](#)” section, we review theoretical discussions and previous studies that provide the background for this study. In “[Empirical analysis](#)” section, we analyze data and empirical results. In “[Results](#)” section, we summarize the results and discuss the implications for future studies.

Literature review

The low fertility rates and rising age for marriage have become serious social issues for Korea. Consequently, many studies have been conducted to determine the causes and to propose policies to counteract these trends. Existing research on factors that facilitate a rise in birth rates has adopted the following research approaches: socio-demographic approach, economic approach, and cultural approach. Previous research that has adopted a socio-demographic approach focuses on demographic factors such as the age of women when they first get married, characteristics of spouses, and educational level. Existing research with an economic approach explains birth rates based on aspects such as utility and cost. Finally, research based on a cultural approach emphasizes the influence of cultural factors such as attitudes towards childbirth and gender preferences. Of course, these approaches are not mutually exclusive and thus overlap to some extent.

The socio-demographic analysis of determinants of birth rates shows that the higher the educational level of women, the higher their employment rate and the longer their educational pathway. This leads women to get married at a later stage in life. Hence, the fact that women are now more likely to obtain a higher education degree negatively impacts childbirth rates. Since a higher level of education correlates with a higher salary, a woman who holds a higher education degree is, once she quits her job after childbirth, more strongly affected by opportunity costs. Ryu and Park (2009) use the risk level

model to analyze the influencing factors on the age of marriage and of first childbirth. The model is based on successive birth cohorts with their fertility rate and accumulated fertility rate. The scholars found that the age of marriage increased for the latest cohort. In a risk analysis, they found that the younger the women are, the later they get married. Educational level is another factor that has been found to delay marriage. Moreover, Lee et al. (2005) show that the older the age of marriage, the riskier any ensuing childbirth. As fertility for women is restricted in time, women's age of marriage and the time at which they have their first child have a significant impact on the general fertility rate. However, researchers are not in agreement on this matter. Choi and Song (2010) assert that the reason for contradicting conclusions is a lack of information on the household income. In other words, data analysis that uses retrospective information on marriage and childbirth or data on already married women does not take into account women's economic circumstances before marriage and the impact these might have had on the decision of getting married. Therefore, this kind of approach does not reflect the impact of women's circumstances prior to marriage on birth rates.

Economic approaches to childbirth focus on the utility of childbirth and the accompanying costs, as determinants for the analysis of childbirth. These approaches are linked to socio-demographic approaches in terms of the costs related to having a child. In other words, these studies explain how individual and social factors such as age and educational level have an influence on women's decision on whether or not to have a child and thereby impact birth rates. An important feature of the economic approach is that it assumes children to be goods, who influence the utility function. Becker (1960), Becker and Lewis (1973), Becker and Tomes (1976) suggests the Quantity–Quality Tradeoff model as a means for explicitly considering the number of children (quantity) and the quality. This model has been employed in many empirical studies using data from all countries.

Regarding childbirth, Cho (2006) and Choi (2008) put forward good examples of the economic approach in Korean studies. Using the life-cycle income hypothesis of women they theoretically analyzed how consumption, labor, and childbirth are related, and empirically tested their thesis based on domestic and international statistics. In search of a suitable policy for promoting fertility rates in Korea, Cho (2006) conducted an experiment and concluded that aids for supporting children's education and the proportional deduction from one's income were more effective than common supports such as child care benefits. Calculating the potential expenses related to childbirth, Choi (2008) points out that the large variation in prospective costs can be accounted for by the decreased ability to participate in the labor force when becoming a parent and the resulting opportunity costs.

These opportunity costs have been rising because of the increase in women's wages, which have been growing due to higher education degrees. Choi concludes that to enhance the fertility rates the impact of decreased labor force participation needs to be mitigated especially by facilitating the return to the labor market after childbirth.

In a study on child care support and the economic participation of parents with children aged 0–5, Hong and Kim (2012) argue that the prospect of receiving child care benefits increases the economic participation of mothers with young children. However, they assume that this does not have a significant impact on the birth of additional

children and assert that child support benefits and labor market policy should be implemented complementarily. Cha (2005) analyzed financial differences for nuclear families with one child and where the woman is still of childbearing age. Families who said that they are not going to have another child were defined as 'low-fertility' families and were compared to those who said that they are planning to have another child in terms of consumption and spending behaviors. Cha carried out an empirical analysis of anticipated educational and child-rearing costs that arise through the birth of an additional child. The outcomes of her analysis suggest that families that decide to have no further children tend to spend significantly more money on a child's education than those who plan for further children. In regard to income elasticity, Cha (2005) shows that low-fertility families have significantly higher elasticity when it comes to the educational costs of children. Cha argues that this result indicates the strong desire of low-fertility families to enhance the life quality of their existing children by spending more money on them. According to this interpretation, low-fertility families prefer to spend more on a single child than investing in additional children. These findings indicate reasons for low fertility rates that cannot be addressed by simple economic compensations, such as child care benefits.

Shin (2008) conducted a more explicit analysis of the burden of child-rearing costs and their impact on fertility rates. In this study, Shin found that there is no statistically significant correlation, which means there is no *ex ante* difference in terms of birth rates, between families that are willing to bear the burden of educational cost and those that are not. He shows that low fertility rates are not due to the necessity to increase spending in order to improve the quality of services provided to children but due to external factors that impact educational spending, such as differences in costs across the education sector. Another aim of this study was to analyze the causal effect of child-rearing and educational costs on fertility rates. According to the outcomes, there are no statistically significant effects of child-rearing and educational costs at present. However, if due to external reasons the scale of this spending decreases to a certain level, this would have an impact on future fertility rates of families who answered that they are not planning on having any further children. Based on this insight, Shin proposes that the low fertility rate should be addressed by developing effective policies for the reduction of child-rearing and educational costs. The studies by Shin (2008) and Cha (2005) are significant in that they analyzed factors that determine birth rates by testing a Quantity–Quality Tradeoff Model empirically. However, their analyses are limited in that they used the intention to have a child as a major variable, rather than actual childbirths.

Freedman (1995), who emphasizes the importance of cultural factors, argues that low fertility rates are caused by socio-cultural factors, and not economic ones. If people are better off due to economic prosperity, they tend to favor stability and individuality. As the consumption habits of unmarried, young people rapidly increase, affluent individuals postpone marriage and childbirth to a later stage in life, and thereby further low fertility rates. Lee et al. (2005), who urges the significance of marriage patterns, asserts that late marriage and lifelong singlehood are crucial factors for explaining low fertility rates. According to his study, late marriage increases the age at which couples choose to have their first child, which not only reduces the remaining childbearing period, but also decreases the child-rearing capability of parents.

As pointed out by Lee et al. (2005), there have been a lot of studies on factors that determine birth rates. Ultimately, birth rates are determined by the supply and demand for children and the opportunity for individuals and couples to fulfill their motivations for having a child. The ability to do so is influenced by predicted child-rearing costs. Not only do these costs include financial expenses, but also time, social norms, health, and psychological costs as well as economic and social status. Following an economic approach, this study focuses on the effect of all personal costs, financial and otherwise, having a child entails. The authors especially try to analyze the expected child-rearing costs on childbirth. While costs in economics cover not only direct costs, but also indirect costs, this study only handles child-rearing/education costs paid directly by parents. This is timelier in that childbirth promotion policies in Korea focus on reducing direct costs.

While there have been a lot of studies on the effectiveness of policies that provide financial incentive, it does not seem that there is a clear consensus among researchers. For example, Laroque and Salanie (2014), who analyzed the impact of child-rearing support in France using utility maximization model of standard life-cycle, concluded that €150 a month has a significant impact on increasing the birth rate and an even stronger effect on children who are born third or later. Regarding Korea, Choi and Song (2010) analyzed the impact of financial support on the intention to give birth. In this study, they found no significant impact from financial support. Also regarding Korea Hong and Kim (2012) analyzed the impact of financial support on women who already have a child, but found no significant impact.

However, these studies have a limitation in that they used the intention to give birth as a dependent variable and not an actual childbirth. Lee et al. (2010) adopted various models and found that there is a strong positive impact of financial support on childbirth in Korea. However, due to data limitations, they did not analyze direct child-rearing and education costs. As mentioned in the introduction, for prospective parents, child-rearing costs are an expected quantity that has not been spent yet. But since data including actual childbirth and unrealized future child-rearing costs are not readily available, this has not been fully examined in existing studies. Nevertheless, the findings from the present study can give useful implications to policymakers. The following sections discuss how to circumvent this difficulty using statistical material and suggest brief empirical results.

Empirical analysis

Data and variables

To analyze the impact of expected child-rearing costs on childbirth decisions (intention), this study used two sets of data. The first set is the Panel Study of Korean Children (PSKC) developed by the Korea Institute of Child Care and Education. This is a longitudinal study of 2150 households with women that gave birth to a child in a sample medical clinic throughout the country between April 2008 and July 2008. Annual surveys were conducted and five waves of panel data have been accumulated until 2012. Since 2011 (the fourth wave of PSKC), the teachers of childcare centers or kindergartens who were in charge of the child have become subjects of this study. The survey targeting parents included household, child-rearing, and psychological features of parents as well as

the development of children. For a study targeting children, major developmental tests have been conducted. For a study targeting the teachers of child care service institutions, the study measured the environment of institutions, behavioral characteristics of children, and the features of teachers. The data are very useful because they are based on a nationwide sample and include information on the development of children in Korea and their developmental environments. However, since these data stem from already-born children, their use for analyzing birth rates is limited.

That is why this study used the Korea Longitudinal Study of Women and Families (KLoWF). These are longitudinal data of women who live in Korea and were aged between 19 and 64 from 2007 (the first wave) to 2012. The size of the original sample was 9007 and, up to the fourth wave, the response rate was 76% of the original sample. Unlike the PSKC, this study analyzed the history of childbirth of the women in the sample, which reveals that during the first survey there were 198 childbirths, 121 in the second survey, 116 in the third survey, and 71 in the fourth. As the subjects of this study were women from all over the country regardless of their childbirth experience, it can be applied to analyze birth rates. However, this material lacks information on child-rearing environment and costs, which is complemented by the data from the PSKC. In these data, the author not only included the information on childbirths of individuals, but also basic demographic features on children, developmental indicators, demographic features of parents, household characteristics, and child-rearing and educating environment. Table 1 summarizes the basic characteristics of the PSKC and the KLoWF. Compared to existing research, the present study has unique significance in terms of research methods, for it adopted the way of matching the separate datasets considering logical and concrete variables of individuals.

Table 1 Sample design of Korea Longitudinal Study of Women and Families (KLoWF) and Panel Study of Korean Children (PSKC) (Source: (1) Korean women’s development and institution (2012). Korea Longitudinal survey of women and families: the 2012 Annual Report, (2) Korean women’s development and institution (2013). Korea Longitudinal survey of women and families: the 2013 Annual Report, (3) Korea institution of child care and education (2012). Panel Study on Korean Children (PSKC) 2012, (4) Korea institution of child care and education (2013). Panel Study on Korean Children (PSKC) 2013)

Subjects	Korea Longitudinal Study of Women and Families (KLoWF) All women at the age of 19–64	Panel Study of Korean Children (PSKC) Children born between April and July, 2008 and their families
Sample size		
2007	9997	
2008	8666	2078
2009		1904
2010	8376	1802
2011		1754
2012	7658	1703
Research cycle	Every 2 year	Every year
Information on child-raising cost	Some	Detailed information

Analysis

To combine the materials from two different panels, this study used the method of kernel matching.¹ This technique defines the distance between observed values and assigns a particular type of distribution to the distance to measure the non-similarity of observed values included in the two datasets. Furthermore, it computes a weighted value in accordance with the distance between the observed values. If the distance is far, an observed value will be low and if the distance is close, an observed value will be high. This study used the KLoWF data in order to analyze childbirth intention. These data do not have sufficient information on child-rearing costs. On the other hand, while PSKC is not suitable for analyzing childbirth decisions (intention), it includes detailed information on child-rearing environment and costs. That is why this study has drawn the information on child-rearing costs from PSKC, imputed it into the KLoWF data, and measured the socio-demographic distance of all women included in the two panel studies. These distances have been used to calculate the weighted values. In another step, the weighted average of the child-rearing costs variable of PSKC was imputed to KLoWF. This was done by matching all women in KLoWF to all observed values in PSKC. Each individual has different structures of weighted value in accordance with the socio-demographic characteristics used in measuring the distance. The child-rearing costs from PSKC were equivalent to the expected costs in KLoWF because those were analyzed by matching to childbirth intention, not real childbirth. This can be mathematically expressed as follows:

$$\tilde{C}_i = \sum_{j=1}^j \tilde{c}_i \cdot \omega_{ij}$$

As C_i , the expected child-rearing costs faced by a woman I , was not observed in the material, the study used instead C_j , the child-rearing cost faced by respondent j in PSKC. To do this, socio-demographic distance between woman I and the entire respondents ($j = 1, 2, \dots, J$) in PSKC was calculated, respectively, which have been used to calculate weighted values ω_{ij} for all possible couples (i, j) . Then the weighted average \tilde{C}_i of C_j calculated for the entire PSKC was used instead of C_i . Distance in this study is defined in accordance with Mahalanobis distance,² and Epanechnikov kernel³ was used to calculate the weighted values. This study defined the child-rearing age of women as between 19 and 39.⁴ For analysis, it used the women of these ages which were observed in KLoWF. And to measure the distance between the observed values included in the two datasets, the study extracted the following as candidate variables: the age of women, educational level, marriage status, employment status, working hours, number of household, family structure (nuclear family and extended family), household income, home-owning status, household assets, and household liabilities from the first wave of the two datasets (PSKC

¹ Cameron and Trivedi (2005).

² Mahalanobis (1936).

³ To compare the sensitivity of the kernel selection, Uniform, Triangle, Gaussian, and Quadratic kernels have been used to calculate the results, which were not significantly different from those measured by Epanechnikov kernel.

⁴ While 15–45 years are generally used as childbearing ages, this study defined the ages more narrowly in view of the actual age distribution of mothers in PSKC.

and KLoWF).⁵ To avoid the distortion in results by arbitrarily selecting matching variables, Akaike Information Criteria (AIC) and Bayesian Information Criteria (BIC) were used to select and analyze models. In other words, the combination of these matching variables was changed to calculate the distance and the weighted values for each case. Moreover, some variables⁶ that have been assessed identically in the two datasets were used as the ultimate imputation variables to select the combination of matching variables which showed the lowest values of AIC and BIC. Based on this, in the actual analysis, the authors excluded the number of household members and working hours from the matching variables.⁷

A dependent variable primarily used in this study is the childbirth behavior of the women at childbearing age. Women subject to this age were 6228 among the samples in the first year and there were 506 cases of childbirth from 2007 (first year) to 2012 (fourth year).⁸ For analysis, a logit regression model is introduced as shown below:

$$\Pr(Y = 1|C, X) = F(\alpha + \beta C + \gamma X),$$

where Y is a separate dependent variable indicating the history of childbirth and C represents expected child-rearing costs. X is a vector containing other explanatory variables. [Appendix](#) (Tables 4, 6) presents the basic statistics of the KLoWF data used in this study. As described above, child-rearing costs variable 'C' does not exist in the KLoWF data, it was extracted from PSKC and imputed to KLoWF based on the matching method. To do that, the study used variables indicating the frequency of using child care service institutions and average monthly costs of use. [Appendix](#) (Tables 7, 10) shows the basic statistics of these variables. There are several aspects worth noting in these statistics. First, child care centers make up the majority (90.8%) of child care service institutions that mothers use during the day; 3.7% of mothers used child care service institutions coupled with private alternative caregivers ([Appendix](#), Table 8). Second, in terms of the frequency of using child care institutions, the majority of mothers (98%) use them 5 days a week (from Monday to Friday). Regardless of the sex of children and the employment status of mothers, the frequency was the same. Third, the cost of using child care was in average ₩199,300 per month, ranging from ₩10,000 to ₩1,200,000 ([Appendix](#), Table 10). Higher birth order correlates with higher education level of the mother, higher household income, and higher spending. Furthermore, employed mothers and those who live in medium and small cities spend more on child care service institutions.

In this study, in particular, monthly average costs presented in [Appendix](#) (Table 10) were used importantly. However, one needs to be careful in interpreting results based on this variable since expenses presented in [Appendix](#) (Table 10) were the monthly costs for children aged 3, while intention to give birth may be influenced by all of the

⁵ While each data includes richer socio-demographic characteristics variables, only variables that have been assessed identically can be compared due to the characteristics of the matching method. Because of the differences in the questionnaires used in the two datasets, matching variables that can be used in the actual analysis were limited.

⁶ Household income, household assets, and household liabilities were used.

⁷ While AIC and BIC do not give an absolute solution to the generalized optimal choice of the combination of matching variables, they help us to choose the best options among available variables.

⁸ The following births were reported: 198 (for the first year: 2007), 121 (for the second year: 2008), 116 (for the third year: 2010), and 71 (for the fourth year: 2012). In the case of recently released fourth year data, women who were currently pregnant at the time of the survey were included. See [Appendix](#) Tables 4 and 5.

potential expenses throughout the child-rearing period. First, this cost variable does not capture the cost of child-rearing before the age of three. Second, this variable captures the expenses directly paid to child care service institutions even after the age of three. Third, this cost variable does not capture child-rearing costs after children enter elementary school, even if we assume that the same amount of money is used to raise children before they enter elementary school. That is why the analysis presented in this study is limited to the effect of expenses paid directly to child care services from the age of three to before entering elementary school. It should be noted that there are fundamental limitations in this study, one of which is that it is beyond the scope of this study to account for the impact of other costs (for example, the opportunity costs of the mother) and educational costs after elementary school on childbirth.

Results

Tables 2 and 3 present the results of the logit regression analysis, using the indicated variables.⁹ Table 2 presents analyses, by the entire sample and by educational level, on how prospective costs of nurturing children impacts childbirth. Increased prospective costs have a small negative impact on childbirth, especially for women with a low education level but not for women with a high education level. A similar finding can be seen in Table 3, which shows analysis results by income level. The increased cost of nurturing children has a negative impact on childbirth for the low-income class only. This suggests that changes in nurturing costs have little impact on childbirth among people of higher education and high-income class; this group, of course, bears a relatively small burden in terms of child-raising costs. While there was a certain level of impact for low-education and low-income class, statistical significance was not strong and the scale of the marginal effect (dp/dx) was very limited. For example, without considering any explanatory variables, if the cost of raising children is increased by ₩100,000 a month from 3 years old before entering elementary school, the chance of childbirth decreases by 0.6% for those who did not go to university. But if we add other socio-demographic variables to the model, this effect almost disappears.

Findings

The recent trend of marrying later in life and the low fertility rate in Korea have led the Korean government to provide childbirth grants and Early Childhood Education and Care (ECEC) as a means of helping to raise the fertility rate. Among the various childbirth encouragement policies by the Korean government, this study focuses on the ECEC subsidies. Through the ECEC subsidy system, the government tries to decrease the expectation of child-rearing costs and promote greater childbirth rates. Using the combined Panel Study of Korean Children (PSKC) and Korea Longitudinal Study of Women and Families (KLoWF) data, this study has analyzed the relationship between childbirth and expected child-rearing costs. The method of kernel matching was used to combine and analyze the information on the age of women and intend of childbirths from the KLoWF and child care environment and the child-rearing costs from the PSKC.

⁹ While the number of the total sample in that age group was 6228, many cases were omitted due to missing in the survey or non-response. In these cases, it is not possible to check whether they gave birth in that year. That is why the authors only included those who responded all four cases (from the first year to the fourth year). For the actual sample size used in the analysis, see Tables 2 and 3.

Table 2 Impact of expected child-rearing cost on childbirth: total and in accordance with educational level

Dependent variable: childbirth = 1, no childbirth = 0	Total	Non graduates	Over university-graduates
Panel A: No additional explanatory variables			
Expected child-rearing cost	-0.00232* (0.00108)	-0.00610* (0.00325)	0.00090 (0.00522)
Pseudo R ²	0.0421	0.0935	0.0203
Panel B: Added the age of mothers and employment status to variables			
Expected child-rearing cost	-0.00271* (0.00142)	-0.00554* (0.00294)	0.00513 (0.00384)
Pseudo R ²	0.0694	0.1230	0.0351
Panel C: Added family structures (such as living with grandparents) to variables			
Expected child-rearing cost	-0.00261 (0.00188)	-0.00332 (0.00211)	-0.00198 (0.00131)
Pseudo R ²	0.1120	0.1209	0.0561
Panel D: Added the level of parents' education to variables			
Expected child-rearing cost	-0.00233 (0.00151)	-0.00251 (0.00165)	0.00291 (0.00511)
Pseudo R ²	0.1621	0.1884	0.1032
Number of samples	3052	1929	1123

This is a logit regression conducted based on dependent variables, childbirth history of women of childbearing age in KLoWF for 5 years from 2007 to 2012, and explanatory variables, variable of nurturing costs imputed using PSKC. Coefficient values presented in the table is the marginal effect of logit regression (dp/dx). If prospect cost of nurturing children increases by ₩100,000, this is interpreted as a change of childbirth intention. Values in parentheses are robust standard errors

*, **, and *** means statistical significance at the significance level of 10, 5, and 1%, respectively

Table 3 Impact of expected child-rearing cost on childbirth: total and in accordance with income level

Dependent variable: childbirth = 1, no childbirth = 0	Total	Low income	High income
Panel A: No additional explanatory variables			
Expected child-rearing cost	-0.00221* (0.00107)	-0.00402* (0.00221)	-0.00038 (0.00247)
Pseudo R ²	0.0554	0.0698	0.0351
Panel B: Added the age of mothers and employment status to variables			
Expected child-rearing cost	-0.00207* (0.00119)	-0.00325* (0.00177)	0.00014 (0.00136)
Pseudo R ²	0.0784	0.0950	0.0487
Panel C: Added family structures (such as living with grandparents) to variables			
Expected child-rearing cost	-0.00102 (0.00228)	-0.00132 (0.00154)	-0.00068 (0.00291)
Pseudo R ²	0.1201	0.1154	0.0685
Panel D: Added the level of parents' education to variables			
Expected child-rearing cost	-0.00084 (0.00144)	-0.00192 (0.00141)	0.00321 (0.00261)
Pseudo R ²	0.1751	0.1458	0.1384
Number of samples	3052	1526	1526

This is a logit regression conducted based on dependent variables, childbirth history of women of childbearing age in KLoWF for five years from 2007 to 2012, and explanatory variables, variable of nurturing costs imputed using PSKC. The classification between low-income and high-income classes was based on median income in the sample. Coefficient values presented in the table are the marginal effect of logit regression (dp/dx). If prospect cost of nurturing children increases by ₩100,000, this is interpreted as a change of childbirth intention. Values in parentheses are robust standard error

*, **, and *** means statistical significance at the significance level of 10, 5, and 1%, respectively

The results of the present study suggest that even a ₩100,000/month subsidy will not change the decision on whether to give birth. In relation to this, it should be noted that there have been similar conclusions in existing studies, although they used different data and statistical techniques. For example, Hong and Kim (2012) used the 2009 nationwide child care status to show that financial support for raising children does not play an important role in decisions about childbirth. However, they used as a dependent variable the intention to give additional birth, not the actual childbirth. Yoo (2011), who used self-response data, also found out that there was no significant impact of financial support on childbirth and the impact was found to be greater in low-income households.

The implication of these studies, including the present one is that financial support for raising children does not have a significant impact on the actual childbirth or desire to give birth. There can be a lot of interpretations about this. One point that needs to be mentioned first is that the financial support used in the analysis is far less than the prospect costs that potential parents expect and thus does not have a significant impact on the actual childbirth. The costs needed to raise a child considered by potential parents are not just expenses needed when their child is an infant or a baby, but the entire expenses needed until they grow up to be adults. And the costs needed in this period should not just include direct cost paid to child care services, but include opportunity cost in the labor market as well as the psychological and potential unforeseen costs. In this regard, the proportion of costs paid to child care services is very small compared to the entire cost of raising children and this is why governmental support for the former expenses has little impact on promoting higher birth rates.

Although there are many studies on the relationship between childbirth and expected child-rearing costs, it is not easy to find an analysis using actual childbirth data. In this regard, this study is meaningful, because panel data were used to show a clear relationship between a low childbirth rate and expected child-rearing costs. For the future, we hope more advanced research will be conducted using the similar methods.

Conclusions

This study finds a weak relationship between childbirth and the expected child-rearing costs; the relationship is more prominent in the low-education and low-income group. Other studies using similar contexts have also drawn similar conclusions. For instance, Hong and Kim (2012), using the 2009 national survey of child care centers, showed that child care subsidies had little influence on childbirth. In addition, Yoo (2011), based on data from self-recording tapes, also found the same results. Thus, according to the studies, including this one, the ECEC subsidy which only partially covered the child-rearing costs did not significantly influence childbirth or the making of a decision in favor of childbirth.

First of all, the child-rearing costs used for this study account for only a small portion of the overall cost that parents expect to pay when they raise their children. Thus, it might be problematic to connect this cost to making a decision in favor of childbirth.

The child-rearing costs that potential parents consider when deciding to have a baby includes not only the direct expenses but also the overall child-rearing costs from birth to adulthood, including the psychological and unforeseen expenses. Therefore, the cost of early childhood is only a small proportion of this total. Especially, a small increase or decrease in the child-rearing costs has little impact on high-education and high-income groups. In addition, since the opportunity costs of the high-education and high-income group are larger than the low-education and low-income group, the potential overall cost that factors into a decision about childbirth is relatively larger and the proportion of direct expenses for early childhood goes down.

Although this study found a relationship between childbirth and the expected child-rearing costs in the low-education and low-income group, it is not statistically significant due to the limitations of the analysis method and the complicated process of making a decision about childbirth. Despite the incomplete data on child-rearing costs, its effect on making a decision about childbirth is shown only limitedly, especially for the low-education and low-income group. If the marginal effects of the child-rearing costs, shown in Tables 1 and 2, can be interpreted as the marginal effects of ECEC subsidies, we can draw the following conclusion: Although the government provides a subsidy of KRW 100,000 per month to every child 3–5 years old, this amount will do little to change the current childbirth decisions by potential parents. This result can be caused by the relatively small proportion of the actual expenses of early childhood in the overall child-rearing costs. Therefore, the government needs to provide not only the ECEC subsidies but also various policy programs of financial support which cover both childhood and periods of adolescence. Moreover, in order to promote childbirth, it is necessary to provide all the policy programs that address solutions for various problems caused by childbirth such as the disruption to a caregiver's career as a package.

Implication

Based on research results above, there are several implications on related policy. First of all, Korea seems to need a multifaceted analysis on the effects of child-rearing support policies in order to increase birth rates. The current low fertility issue that Korean society faces stems from extremely complex problems beyond the amount of expenses such as child-rearing costs and afterbirth expenses as previous studies have pointed out. A child-rearing support policy that aims to increase fertility should take into account the need to design a more parent-friendly social infrastructure, such as shorter working hours and job security in addition to a support system of child care and education services for young children. Furthermore, all costs of child-rearing should be taken into account, not just that of early childhood.

Recent studies, including this one, that analyze the effects of compensating for expenses remain mostly a type of discussion on policy effects of a single support policy. Because of this, there should be a longitudinal study focusing on a multifaceted and comprehensive support policy.

This study conducted an analysis on effects using the Panel Study of Korean Children and Korean Longitudinal Survey of Women and Families, but did not consider several variables in a multidimensional way due to the complexity of the matching process. Further studies should additionally consider the effects of comprehensive policies including compensational payment for opportunity costs of child-rearing due to reduced labor force participation, educational costs after childhood, and additional costs during early childhood and not focus only on child-rearing education costs as for the expected child-rearing expense.

Second, for the government to improve fertility rates, the results suggest, that a customized support policy is needed. In other words, child-rearing costs affect women's decision to have a child differently according to her educational background and income level. This also suggests the direction in which current policy should be modified. It should consider designing a customized child-rearing support system that considers resources differences and socio-economic characteristics of a household.

Although an analysis of the panel data is statistically less significant, it shows that mothers with less college education and from a low-income background tend to be less willing to have children. In comparison to lower-educated mothers with less income, the expected child-rearing costs of mothers with college education and higher income have less to no impact on a decision for childbirth. Considering this fact, financial support for child-rearing (mean child care and education costs in this study) for groups with low income and low education has only a slight effect. A different way must be found to support this group.

To improve Korea's fertility rate, the government, rather than offering financial support, should try to establish conditions for childbirth and child-rearing that satisfy the demands of the high-income and high-education group, such as quality of environment and child-rearing. A first step is to carry out a detailed examination of other support policies besides financial ones. On the one hand, the fact that support policies such as benefits or allowance to low-income and low-education groups are effective but only slightly significant in a statistical way implies the necessity to consider other determinants than financial benefits. Therefore financial support for child-rearing should consist of differential assistance applying a universal supporting policy from the perspective of social infrastructure and situations.

Limitation

In the process of combining KLoWF and PSKC, it could be observed that the samples from PSKC included more highly educated, "white collar," and regular working women than did those from KLoWF (shown in [Appendix, Table 11](#)). Even if the authors limited the sample to childbearing age at a similar period, samples of PSKC consisted of relatively younger, higher-educated persons, and a larger proportion of persons with professional/white collar and full-time workers. This is due to the differences in the sampling strategies of the two datasets. While KLoWF draw sample of women aged 19–65 regardless of marriage or childbirth experiences, PSKC extracted sample from mothers who gave birth in standard medical clinics.¹⁰ This also explains the fact that most of the

¹⁰ Due to this sample design, mothers who gave birth at a small hospital with fewer than 500 births a year and at midwifery service center are not included in the sample.

women in PSKC were married (99%), whereas only 83% of those in KLoWF were married.

In addition, despite the research results and suggestions mentioned above, financial supports for child care center and kindergarten costs should be regarded as social policies for reducing social disparities during early childhood and developing future human resources. It is not a plan to tackle the low birth rate. Analysis conducted in this study has the limitation of not broadly covering the financial utility of a child care support policy, and the results should be confined to the influences of expected child-rearing expenses on women's childbirth behavior. To extend this study, future research should include parents who already have a child as well as potential parents in the present study to see the effect of financial support for child-rearing cost because they have experience with the costs and are also potential parents for the next child.

Also, as shown in this study, future research should explore why financial support for kindergarten and child care centers has not improved the fertility rate. For example, financial support for child care in France is reported to have increased fertility rates. This stands in contrast to the situation in Korea, in that social-demographic factors such as a high rate of immigrants and their multi-child families have contributed to the increase in France's fertility rate (Laroque and Salanie 2014). This suggests that financial support for child care can lead to positive effects on the decision to have (additional) children. Therefore, it is necessary to consider targeting multi-child families, that is, families that have already made childbirth decisions, to discover the type of directly supporting child care costs that are effective.

Financial support should not be hastily implemented as a policy that contradicts the current system of child-rearing supports since it does not help increasing the fertility rate in the short term. Before that, there should be a chance to discuss deeply with policymakers and researchers the needs of the entire society and the major motivation for increasing the fertility rate.

Authors' contributions

EK designed the study, acquired the data, and drafted and revised the manuscript. SK performed the statistical analysis and drafted a part of the manuscript. JL helped acquire the data and draft the manuscript. YC participated in designing of the study and drafted a part of the manuscript. ND participated in the statistical analysis and drafted a part of the manuscript. DL participated in coordination and helped draft the manuscript. All authors read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

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Appendix

See Tables 4, 5, 6, 7, 8, 9, 10 and 11.

Table 4 continued

	2007			2008			2010			2012		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
N	9769	6001	198	8184	4813	119	7803	4089	115	7449	3542	7
Husband's education (%)												
Less than college	53.56	44.69	51.01	55.21	45.05	39.50	54.90	43.59	46.09	54.01	42.50	50.0
College graduate	46.44	55.31	48.99	44.79	54.95	60.50	45.10	56.41	53.91	45.99	57.50	50.0
N	9969	6095	198	8344	4881	119	7976	4159	115	7637	3635	7
Husband's work status (%)												
Working	87.33	93.83	95.41	83.76	90.15	95.76	87.76	95.11	94.78	79.72	97.82	84.2
Not working	12.67	6.17	4.59	16.24	9.85	4.24	12.24	4.89	5.22	20.28	2.18	15.7
N	7884	4796	196	6742	3897	118	6388	3272	115	5976	2475	7

(1): total sample, (2): fertility cohort (female age 19–39) and (3): fertility subsample (Those among fertility cohort who had pregnancy between current Md next survey. For example, (3) for 2007; (3) for 2008; 2008 and 2009). Fertility subsample of the fourth survey includes those who are pregnant at the time of the survey. Omitted entries are either omitted by definition or because there are too few observations to be meaningful

Table 5 Basic statistics by Korea Longitudinal Study of Women and Families (KLoWF) (continued) (Source: KLoWF)

	2007			2008			2010			2012		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Economic activity (%)												
Employed	0.43	0.39	0.22	0.46	0.42	0.17	0.51	0.48	0.30	0.54	0.52	0.23
Unemployed	0.03	0.04	0.00	0.02	0.03	0.00	0.02	0.02	0.00	0.01	0.02	0.00
Not in Labor force	0.54	0.57	0.78	0.51	0.55	0.83	0.47	0.49	0.70	0.45	0.46	0.77
N	9992	6112	198	8363	4894	121	7998	4172	116	7658	3646	71
Wage worker												
Monthly wage (won)												
Mean	144.96	152.66	203.69	137.66	145.94	213.33	146.28	155.26	201.14	157.75	167.76	215.83
Standard deviation	84.67	80.53	62.24	82.32	79.27	81.72	77.90	73.01	62.45	89.11	78.00	69.08
N	1552	1195	33	1741	1311	12	1661	1155	22	1730	1113	12
Part time/full time status												
Full time	0.80	0.82	0.97	0.74	0.78	0.75	0.79	0.82	0.92	0.80	0.83	0.80
Part time	0.20	0.18	0.03	0.26	0.22	0.25	0.21	0.18	0.08	0.20	0.17	0.14
N	1985	1493	36	1748	1262	16	2130	1427	25	2167	1344	14
Employment security												
Secure	0.54	0.61	0.94	0.49	0.57	0.81	0.44	0.55	0.76	0.62	0.67	0.79
Nonsecure	0.46	0.39	0.06	0.51	0.43	0.19	0.56	0.45	0.24	0.38	0.33	0.21
N	1985	1493	36	2166	1577	16	2133	1427	25	2167	1344	14
Workplace maternity leave (%)												
Available	0.35	0.41	0.97	0.27	0.33	0.63	0.25	0.32	0.72	0.23	0.30	0.79
Not available	0.58	0.51	0.03	0.68	0.62	0.38	0.70	0.63	0.28	0.71	0.64	0.14
Do not know	0.07	0.08	0.00	0.06	0.06	0.00	0.05	0.05	0.00	0.06	0.06	0.07
N	1979	1488	36	2166	1577	16	2135	1428	25	2170	1344	14

Table 5 continued

	2007			2008			2010			2012		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Hours worked per week												
Mean	45.41	45.19	44.94	43.02	43.39	39.44	41.53	41.76	40.20	40.07	40.21	41.43
Standard deviation	14.41	13.73	7.70	13.70	12.69	13.31	12.40	11.43	6.69	12.93	11.50	11.80
N	1975	1484	35	2165	1578	16	2107	1414	25	2167	1341	14
Nonwage worker												
Monthly income (won)												
Mean	158.50	177.45	151.67	132.32	152.44	100.00	140.28	179.92	178.33	147.85	196.99	200.00
Standard deviation	194.90	141.00	60.14	113.55	128.61	70.71	128.63	151.51	72.23	134.54	155.07	70.71
N	1125	474	6	946	452	2	967	341	6	925	306	2

(1): total sample, (2): fertility cohort (female age 19–39) and (3): fertility subsample (Those among fertility cohort who had pregnancy between current and next survey. For example, (3) for 2007; (3) for 2008; 2008 and 2009). Fertility subsample of the fourth survey includes those who are pregnant at the time of the survey. Omitted entries are either omitted by definition or because there are too few observations to be meaningful

Table 6 Basic statistics by Korea Longitudinal Study of Women and Families (KLoWF) (continued) (Source: KLoWF)

	2007			2008			2010			2012		
	1	2	3	1	2	3	1	2	3	1	2	3
	Household income (month, KRW)											
Mean	3261.90	3651.59	3418.34	3153.19	3579.31	3234.14	3175.62	3681.90	3452.16	3401.87	4010.68	3527.10
Standard deviation	3182.62	2496.44	2583.13	2026.51	1937.69	1546.99	2086.82	1951.99	1597.26	2462.96	2473.68	1823.56
N	9520	5920	203	8253	5024	381	7914	4731	218	7640	4429	115
Household consumption (month 1000 KRW)												
Mean	2204.79	2428.54	1764.88	2213.97	2489.39	2070.84	2237.84	2579.98	2177.06	2282.32	2699.11	2174.81
Standard deviation	1227.25	1174.01	674.84	1192.12	1127.53	703.37	1217.59	1160.54	829.30	1249.12	1177.29	1025.84
N	9875	6154	208	8355	5077	384	7985	4765	219	7668	4440	113
Household savings (month 1000 KRW)												
Mean	422.78	496.77	659.60	445.30	518.39	512.34	485.09	557.67	529.75	494.76	584.97	656.51
Standard deviation	750.87	771.59	823.30	705.99	723.68	611.13	761.28	774.04	667.87	800.44	857.47	958.21
N	9758	6057	204	8323	5059	384	7965	4767	220	7655	4433	115
Household debt (1000 KRW)												
Mean	23,339.33	25,139.33	15,835.48	22,541.22	25,533.76	23,715.95	21,908.33	25,004.62	22,427.63	22,425.08	27,852.43	24,576.46
Standard deviation	122,151.63	129,146.51	28,333.40	55,224.70	59,848.08	42,455.96	54,065.74	55,761.46	45,438.97	53,456.79	59,331.68	47,398.12
N	9627	5971	203	8221	4996	382	7916	4725	219	7592	4394	113
Financial asset value (1000 KRW)												
Mean	19,505.47	20,293.95	14,977.64	20,918.37	21,258.53	16,032.66	23,313.30	23,708.20	19,682.00	26,380.42	27,211.35	19,337.73
Standard deviation	36,850.76	36,028.53	20,057.70	39,660.57	36,883.56	25,880.77	45,481.06	43,236.19	29,016.63	56,419.89	55,211.96	26,627.61
N	9237	5708	197	8140	4936	381	7780	4646	216	7487	4332	115
Real estate asset value (1000 KRW) (other than current residence)												
Mean	45,962.83	40,304.38	14,630.69	50,454.46	42,120.79	21,463.71	47,673.33	40,565.49	21,407.60	57,308.93	48,335.31	28,364.00
Standard deviation	153,992.75	149,405.26	54,500.25	161,149.24	151,885.91	87,938.76	157,106.20	150,215.50	70,968.78	189,875.32	187,195.03	103,403.68
N	9713	6065	206	8280	5040	384	7966	4757	219	7630	4429	115

(1): total sample, (2): fertility cohort (female age 19–39) and (3): fertility subsample (Those among fertility cohort who had pregnancy between current and next survey. For example, (3) for 2007; 2007; (3) for 2008; 2008 and 2009). Fertility subsample of the fourth survey includes those who are pregnant at the time of the survey. Omitted entries are either omitted by definition or because there are too few observations to be meaningful

Table 8 The status of using child support services: type of services (%) [Source: 4th-year report by Panel Study of Korean Children (PSKC) (2012)]

Classification	Ratio	Classification	Ratio
Individual proxy raising	2.0	Individual proxy raising + private academy for more than half- day care	0.1
Daycare	90.8	Individual proxy raising + daycare	3.7
Kindergarten	1.7	Individual proxy raising + kindergarten	0.2
Private academy for more than half- day care	1.4	Daycare + private academy for more than half- day care	0.1
Other institutions such as missionary house	0.1	Daycare + other institutions	0.1
Total (number)		100.0 (1480)	

Table 9 The status of using child support services: frequency of use (% a person) [Source: 4th-year report by Panel Study of Korean Children (PSKC) (2012)]

Classification	Everyday from Monday to Saturday	Everyday from Monday to Friday	All week	Several days during week	Total (number)	χ^2 (df)
The whole	1.2	98.0	0.1	0.7	100.0 (1452)	
Regional scale						
Big cities	0.2	98.8	0.2	0.9	100.0 (566)	15.51 (6)*
Small and medium cities	1.4	97.9	0.0	0.7	100.0 (571)	
Small towns	2.9	96.8	0.0	0.3	100.0 (315)	
Employment of mother						
Employed	1.8	97.7	0.0	0.5	100.0 (657)	5.05 (3)
Not employed	0.8	98.2	0.1	0.9	100.0 (783)	

* $P < 0.05$ **Table 10 The status of using child support services: the average monthly cost of using (₩10,000) [Source: 4th-year report by Panel Study of Korean Children (PSKC) (2012)]**

Classification	Average	Standard deviation	Minimum value	Maximum value	Number	t/F
The whole	19.93	16.90	1.00	120.00	1325	
Birth order						
First-born	21.12	18.00	1.00	120.00	638	8.63***
Second-born	19.93	16.13	1.00	100.00	540	
Third or more	14.73	13.50	1.00	100.00	147	
Employment of mother						
Employed	22.23	16.48	1.00	100.00	604	4.63***
Not-employed	17.94	17.00	1.00	120.00	712	
Educational level of mother						
High school or less	13.74	13.26	1.00	100.00	418	75.24***
Community college graduates	17.64	15.03	1.00	110.00	355	
College graduates	26.08	18.36	1.00	120.00	547	
Household income						
Less than ₩3,000,000	12.46	13.53	1.00	120.00	439	75.35***
₩3,010,000 to ₩4,000,000	18.31	15.05	1.00	100.00	292	
₩4,010,000 to ₩5,300,000	22.23	17.26	1.00	100.00	236	
over ₩5,310,000	28.89	17.31	1.00	110.00	358	
Regional scale						
Big cities	20.09	17.23	1.00	120.00	525	15.51***
Small and medium cities	22.25	17.51	1.00	110.00	518	
Small towns	15.36	14.06	1.00	70.00	282	

Table 11 The comparison of basic statistics measured by Panel Study of Korean Children (PSKC) and Korea Longitudinal Study of Women and Families (KLoWF)

	N	Mean	Stdev	Min	Max	T test	KS test	P value
m_age								
PSKC (2008)	2077	31.34	3.72	19	46.00	t	D1	0.39
KLoWF (2007)	3830	35.19	6.29	18	45.00	df	D2	-0.04
							D	0.39
m_educ								
PSKC (2008)	2062	14.28	1.96	0	21.00	t	D1	0.00
KLoWF (2007)	3824	13.34	2.23	0	22.00	df	D2	-0.22
							D	0.22
								Years of schooling
m_mar								
PSKC (2008)	2072	0.01	0.12	0	1.00	t		
KLoWF (2007)	3830	0.17	0.37	0	1.00	df		
								0: married
								1: not married
m_employment								
PSKC (2008)	2073	0.32	0.47	0	1.00	t		
KLoWF (2007)	3830	0.39	0.49	0	1.00	df		
								0: no work
								1: work
m_workhour								
PSKC (2008)	626	43.89	12.37	3	96.00	t	D1	0.12
KLoWF (2007)	1482	46.50	17.93	2	156.00	df	D2	-0.10
							D	0.12
								h/week
m_jobcode								
PSKC (2008)	629	0.18	0.38	0	1.00	t		
KLoWF (2007)	1493	0.55	0.50	0	1.00	df		
								0: white collar
								1: blue collar
m_jobsecurity								
PSKC (2008)	622	0.14	0.35	0	1.00	t		
KLoWF (2007)	1504	0.66	0.47	0	1.00	df		
								0: permanent
								1: temporary
h_size								
PSKC (2008)	2078	3.86	0.94	3	10.00	t	D1	0.10
KLoWF (2007)	3830	3.80	1.04	1	8.00	df	D2	-0.10
							D	0.10
								0: nuclear family
h_family								
PSKC (2008)	2078	0.22	0.42	0	1.00	t		

Table 11 continued

	N	Mean	Stdev	Min	Max	T test	KS test	P value
KLoWF (2007)	3830	0.23	0.42	0	1.00	4301.32		1: extended family
h_inc						df	D1	0.11
PSKC (2008)	2065	3637.69	1731.13	0	14,820.65	-0.65	D2	-0.08
KLoWF (2007)	3676	3672.51	2269.92	0	46,949.55	5234.15	D	0.11
h_finasset						df	D1	0.00
PSKC (2008)	1665	36,142.77	71,111.18	0	855,037.75	10.06	D2	-0.28
KLoWF (2007)	3565	17,848.29	30,986.61	0	5,500,000.00	1965.00	D	0.28
h_dept						df	D1	0.00
PSKC (2008)	1421	36,128.76	65,861.80	0	570,025.19	8.03	D2	-0.18
KLoWF (2007)	3675	20,556.83	50,953.18	0	945,000.00	2109.63	D	0.18
h_housingown2						df		
PSKC (2008)	1863	0.15	0.35	0	1.00	-1.60		0: own+jeonse
KLoWF (2007)	3827	0.16	0.37	0	1.00	3834.16		1: others (not own)

(1) This is a comparison of basic statistics for women of childbearing age; (2) The definitions of each variable are as follows. Age of women subject to study (m_age), education year (m_educ), marriage status (m_marr, 1 = not married), employment status (m_employment, 1 = employed), weekly work hours (m_workhours), type of occupation (m_jobcode, 1 = blue collar job), employment type (m_jobsecurity, 1 = temporary/dayworker), number of household member (h_size), household type (h_family, 1 = large family), household income (h_inc, \1000), financial assets of household (h_finasset, \1000), household debt (h_debt, \1000), home owning status (h_housingown2, 1 = others except for owing house and lease); (3) T test has examined two hypotheses assuming the average of two data is the same; (4) In Kolmogorov-Smirnov (KS) test, D1 and D2 represents the maximum distance when PSKC < KLoWF and PSKC > KLoWF, and D suggests bigger absolute value between D1 and D2

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