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Can child benefits encourage parents' attitudes toward a childrearing environment in Japan?
Effects of the expansions of the child benefit policy

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Can child benefits encourage parents' attitudes toward a childrearing environment in Japan?

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Abstract This study clarifies the effects of the expansion of Japan's child benefit policy (CB) on parental attitudes toward childrearing environments in terms of culture, education, and childcare. A fixed-effect model was employed on data from Osaka University's "Preference Parameters Study," which provides large-scale longitudinal micro-data covering not only specific individuals but also their families. Compared with the control group of parents with only high-school children aged 16-18, the CB expansion, on average, increased the priority given to childcare environments by one grade. The subsample analysis revealed that parents with only pre-school children (0-6 years old) came to hope for a better childcare environment and those with only primary-school-aged children (7-12 years old) demanded a better educational environment. Moreover, by dividing the respondents by whether the household income was above the mean, parents with higher household income levels were shown to increase the priority they gave to the educational environment in exchange for a decrease in the priority given to the childcare environment. However, parents in the lower household income groups increased the priority they gave to the childcare environment. These results indicate that the unpredicted CB expansion led parents to react differently to the neighborhood environment, depending on their child's age and household income. Hence, the most important implication of this study is that the government should carefully choose target households in light of policy objectives and not increase the opportunity gaps between households when introducing new financial support policies.

Keywords child benefit · neighborhood environment · parental attitude · program evaluation · impact heterogeneity

JEL classification H52, I22, I24, I28, J13

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1 Introduction

Based on the economic growth viewpoint, the income gap between the rich and poor households is widening because rich households benefit the most from the recent economic development OECD (2015). The income gap between generations can thus lead to an opportunity gap in accumulating human capital for subsequent generations. The existing research shows that a higher socioeconomic status (SES) is associated with better educational and labor marker outcomes (and vice versa), [1] and, as a result, intergenerational mobility remains challenging. [2]

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[1] See Bradley and Corwyn (2002); Breen and Jonsson (2005); Conger, Conger and Martin (2010); Corak (2006); Hoff (2003); Kulic, Skopek, Triventi and Blossfeld (2019)

[2] See Black and Devereux (2011); Corak (2013); Solon (1999, 2002)

However, there is a need to identify what drives the disparities in child outcomes: heredity or the environment? If the environment contributes to a child's development, the social mobility of those with high ability can be enhanced by providing financial and educational support to economically disadvantaged children. Therefore, many researchers have tackled the nature versus nurture debate by applying various identification strategies (e.g., identical twins, adopted children, and genetic markers).[3] While some studies point out significant correlations between pre- and post-birth factors, they conclude that not only pre-birth factors but also post-birth factors affect a child's economic and educational outcomes. Moreover, Björklund and Jäntti (2012) show that the most important post-birth factor for a child's development is the family-specific background, defined as the experience shared with his/her sibling (measured by the outcome correlation between a child and his/her sibling). However, more recent studies reveal that the neighborhood environment also plays a vital role on a child's outcomes. In sum, these studies suggest that the parental attitudes toward their home and neighborhood environments can likely improve a child's outcomes by increasing the investment in the child's rearing.

In the context of Japan, Matsuoka and Maeda (2015) conduct a review showing that parents in higher SES households attribute higher importance to education, revealing that their attitudes also differ depending on the neighborhood environment (e.g., percentage of college graduates in the neighborhood). As a result, parents in higher SES households tend to spend more on shadow education Matsuoka (2018). These studies suggest that parents would enhance their attitudes toward not only education but also the home and neighborhood environments if their household incomes were to exogenously increase. In this regard, an ideal exogenous variation—that is, the expansion of CB in April 2010—can be used for causal inferences.

Since 1961, the Japanese government has been offering the CB to childrearing households, aimed at reducing the financial burden of increasing childcare costs. As childrearing expenditure kept increasing and household structures kept changing, the government gradually and endogenously expanded the CB until March 2010. However, in August 2009, the Democratic Party in Japan (DPJ) overcame the long-lasting party in power at the time, that is, the Liberal Democratic Party (LDP). The DPJ campaigned for expanding social security services such as childrearing, education, health care, and pensions. Although the electorate did not expect to defeat the LDP, the election led to this unexpected regime change (see Noble (2010)). After April 2010, the DPJ increased the child's age threshold from 12 to 15 years and abolished the household income threshold. As a result, the number of recipients, as well as payments, increased; specifically, the monthly payment increased from JPY 5,000 per child (for first and second children) and JPY 10,000 per child (after the third child or for children under three years old) to JPY 13,000 per child, regardless of age or birth order. Therefore, the nationwide and clear-cut policy changes in the CB resulted in variations in the level of CB expansion among households. This exogenous variation can be regarded as a quasi-natural experiment, with several previous studies estimating the impacts of the CB expansion in April 2010 on various outcomes (See Bessho (2018); Naoi, Akabayashi, Nakamura, Nozaki, Sano, Senoh and Shikishima (2017); Takeshita (2016)).

Specifically, Takeshita (2016) reveals that the CB expansion in April 2010 had no effect on targeted parents' attitudes toward their children's education. Conversely, Naoi et al. (2017) shows that the policy change increased the educational expenditure per child. Overall, these studies imply that parents improve not only their attitudes toward education but also on the surrounding environment, including shadow education and extracurricular activities. Hence, this study tackles the following two research questions:

1. Did the CB expansion in April 2010 enhance parental attitudes toward the neighborhood environment contributing to child development?

2. Which households improved their attitudes toward the neighborhood environment based on the child's age and household income?

The definition of parental attitudes toward the neighborhood environment is thus crucial for this study. The study uses a longitudinal questionnaire survey of 4,335 households selected randomly from a residential map stratified by residential regions and city sizes. The main advantage of this survey is the information on the reasons for which the respondents decide where to live. Out of 17 alternatives, the respondents can choose up to four reasons and rank them in the order of their importance. To estimate the impacts of the CB expansion on parental attitudes toward the neighborhood environment, this study quantifies respondents' priority to cultural, educational, and childcare environments, ranked as 4 for the first place, 3 for second, 2 for third, 1 for fourth, and 0 if not selected; then, these values are used as dependent variables. Moreover, I control for several demographic characteristics.

[3] Refer to the studies on identical twins Ashenfelter and Rouse (1998); Ashenfelter and Krueger (1994); Björklund and Jäntti (2012), adopted children Björklund, Lindahl and Plug (2006); Plug and Vijverberg (2003); Sacerdote (2002), and genetic markers Lehrer and Ding (2017); Lin (2020); Papageorge and Thom (2019); Rauscher (2017); Thompson (2014)

Another important factor is the identification strategy. In comparing the outcomes of the pre- and post-treatment periods, for example, a fixed effects model (FEM) or a difference-in-differences (DID) model can be used to estimate the average treatment effects. The estimators are biased, unless the time series variations in outcomes satisfy the common trend assumption after all covariates are conditioned.[4]. However, there exists the concern of violating the common shock assumption of the CB expansion by the introduction of a free high-school education policy (FEP). Specifically, for the control group, parents with at least one high-school student were newly assigned to the FEP at the same time as the CB expansion.[5] The FEP removed the tuition fee at public high schools, making the education virtually free. Additionally, the government offered an official grant, which was similar for all parents with children studying in private high schools. Hence, the total FEP benefits are directly incorporated into the FEM approach to eliminate omitted variable bias.

Parents with children that have not yet graduated from junior high school are assigned to the treatment group, and the ones with high-school-aged children (ages 16-18) form the control group. The main results, derived by FEM, control for household-level (individual) fixed effects and reveal that the priority assigned by parents to the childcare environment increased by around 0.08 after the CB expansion. [6]

Next, the study classifies the treatment groups by the different effects of the CB expansion depending on the child's age: (1) parents with only pre-school-aged children (ages 0-6), (2) parents with only primary-school-aged children (ages 7-12) that had been treated before the expansion, and (3) parents with only junior-high-school-aged children (ages 13-15) that could receive benefits from fiscal year 2010. As a result, the CB expansion of April 2010 led parents with pre-school children (0-6) to increase the priority assigned to a childcare environment by around 0.17. However, the parents with only primary-school-aged children (ages 7-12) did not improve their attitudes toward the childcare environment but rather increased the priority to the educational environment by around 0.15. The expansion in CB did not have any impact on the priority given to the living environment among parents with only junior-high-school-aged children (ages 13-15).

Finally, by dividing respondents into groups based on being above or below the mean household income, this study analyzes whether the impacts of the CB expansion differ by annual household income. This subsample analysis reveals that parents whose household incomes are above the mean give higher priority to the educational environment by about 0.16, and lower priority to the childcare environment by around 0.1. Moreover, these impacts can only be seen for parents with junior-high-school-aged children. Respondents whose incomes are below the mean household income, however, attribute a higher priority to the childcare environment. Therefore, the study can conclude that the older children are and the higher the household income is, the more parents pay attention to the educational environment. At the same time, the younger children are and the lower the household income is, the more parents pay attention to the childcare environment.

This study makes two important contributions to the literature. First, the study divides parental attitudes toward the environment into three components—cultural, educational, and childcare environments. Previous researches generally combined several neighborhood environment types into one indicator to evaluate the effects of a single proxy variable for the quality of the neighborhood environment on child development. Another literature stream on the impacts of CB expansion (Takeshita (2016)) and the effects of neighborhood SES and their educational attainment (Matsuoka and Maeda (2015); Matsuoka (2018)) evaluates only parental attitudes toward education. Therefore, this study adds to the literature by identifying which attitudes toward the childrearing environment are affected by childrearing financial support from the government. The second contribution relates to identifying the heterogeneity of the CB expansion effects depending on the child's age. In this regard, Lareau (2003) shows that high- and low-SES households have different strategies for child education; specifically, parents in higher- (lower-) SES households provide structured (unstructured) education to their children. These findings imply that the CB expansion has different impacts for higher- and lower-income households. Hence, this study also estimates the subgroup treatment effects, divided by whether the household income is above the mean.

This remainder of the paper proceeds as follows. The backgrounds of the CB and FEP are explained in Section 2. Section 3 describes the empirical methods and procedures, and the data is then summarized in Section 4. The results for the full sample and subsample analyses are shown in Section 5. Finally, the conclusions are presented in Section 6.

[4] See Ashenfelter and Card (1985); Card and Krueger (1994); Donald and Lang (2007)

[5] For the CB and FEP, it is assumed that almost all parents with children aged 18 years or below were assigned to one of these policies after fiscal year 2010, because the compulsory education requirements means that all children need to complete junior high-school by the age of 15, while over 96% of them continue to high school in Japan (MEXT (2017)). This situation makes it possible to mitigate the selection problem. Hence, these policy changes can be regarded as natural experiments for the targeted households.

[6] The FEM approach may produce measurement errors because the priority of each living environment is based on subjective evaluations.

2 Policy Background

2.1 Child benefit policy

The CB was introduced in 1972 through the enforcement of the Child Allowance Act to prevent parents with many children from slipping into poverty.[7] Initially, the policy targeted parents whose annual household income, including tax, was less than JPY 2 million and who had more than three children. As in most countries that implemented a CB, it started as a means-tested cash transfer policy. Detailed information about the historical evolution of the CB from 1972 is shown in Figure 1 and Table 1.

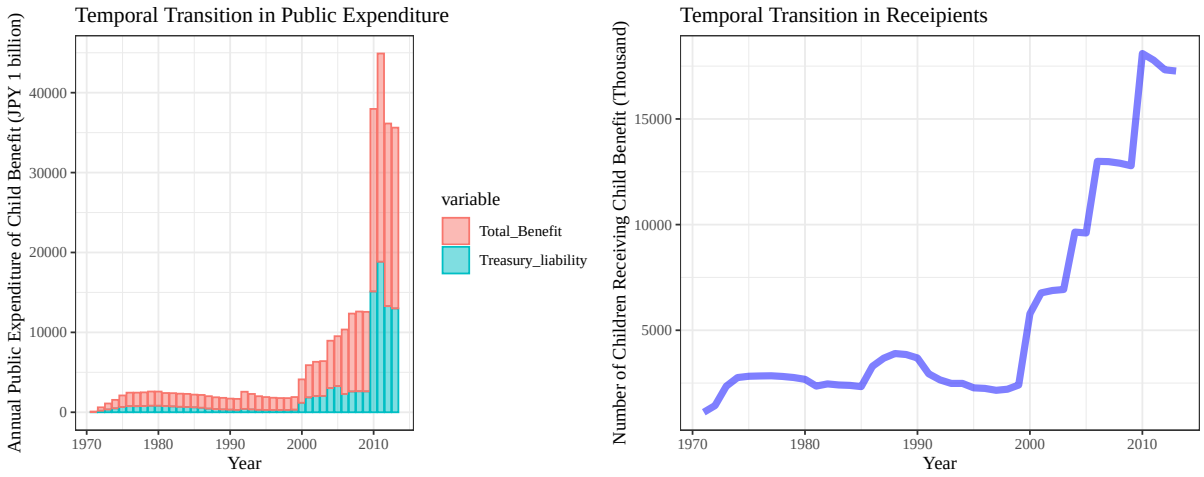

Fig. 1 Temporal Change of Child Benefit in Annual Public Expenditure and Recipients

After the many changes, both on child age and birth order and number of payments, all parents with at least one child aged below 15 became eligible, regardless of the child's birth order; additionally, the income threshold has been abolished since fiscal year 2010. Specifically, before fiscal year 2010, parents could receive JPY 5,000 per child for their first and second children and JPY 10,000 per child for their third child onward until the children graduated from primary school at the age of 12. Furthermore, all parents were paid JPY 10,000 per child if the child was less than 3 years old. However, these payments were offered only to those parents whose household income was less than JPY 7.8 million including tax (JPY 8.6 million including tax for Employees' Pension Subscriber).

After the CB expansion in April 2010, all parents received JPY 13,000 per child until the child turned 15 and graduated from junior high school, without any conditions on household income. Hence, parents with children aged between 13 and 15 could start receiving benefits from fiscal year 2010 onward after the CB expansion, and parents with children younger than 13 were also eligible and could be paid more than before. [8]

However, in October 2011, due to budgetary deficit, the qualification for receiving the child benefits was again revised based on the child's age and birth order. Specifically, all parents could receive JPY 10,000 per child aged under 15 years old. They were additionally paid JPY 5,000 if their child was less than 3 years old or if neither the first nor the second child was between 3 and 12 years old; moreover, the income threshold was revised from fiscal year 2012. These changes in the qualification criteria and amounts paid are shown in Table 1. Therefore, all respondents with children aged 18 or younger received child benefits between April 2010 and October 2011.

In practice, the child benefits in Japan are transferred to households every four months, that is, in February, June, and October. However, the data this study uses were gathered between January and March,[9] so it is unclear whether respondents answered after they had received child benefits based on the new criteria implemented in October 2011.

[7] The Ministry of Health, Labour and Welfare implemented the CB expansion. The policy's jurisdiction was then transferred to the Cabinet Office.

[8] The existing tax credit for dependents was also reduced, according to the income tax for household income in April 2011 (in April 2012 for inhabitant tax). Regarding the policy, Kessho (2018) showed that parents reacted with a decrease in their labor supply. This means they adjusted their labor supply to maintain the pretax total household income unchanged. Hence, the effects of the tax reform were removed by directly controlling for the total household income including tax.

[9] For the 2009 survey, the respondents answered the questionnaires in February and March, and in January and February for the 2010 survey. After 2011, the survey was sent to respondents and the responses were gathered between January and March.

Table 1 Temporal Transition on the Child Benefit Policy in Japan

Enacted Year	Target Children	Supply Period	Threshold of Household Income	Monthly Payment from the Child Benefit (CB)
1972	3rd and After	Until JHS Graduation	200 million JPY	3,000 JPY
1974	3rd and After	Until JHS Graduation	322 million JPY	4,000 JPY
1975	3rd and After	Until JHS Graduation	415 million JPY	5,000 JPY
1986	Only 2nd	Until less than 2 years old	340.6 (558.9) million JPY	2,500 JPY
	3rd and After	Until JHS Graduation	340.6 (558.9) million JPY	5,000 JPY
1992	1rd and After	Until less than 3 years old	↓ Gradually Update	5,000 JPY (1st and 2nd) and 10,000 JPY (3rd and After)
2000	3rd and After	Until KG Graduation	↓ Gradually Update	5,000 JPY (1st and 2nd) and 10,000 JPY (3rd and After)
2001	3rd and After	Until KG Graduation	596.3 (780) million JPY	5,000 JPY (1st and 2nd) and 10,000 JPY (3rd and After)
2004	3rd and After	Until 3rd Grade in PS	596.3 (780) million JPY	5,000 JPY (1st and 2nd) and 10,000 JPY (3rd and After)
2006	3rd and After	Until PS Graduation	780 (860) million JPY	5,000 JPY (1st and 2nd) and 10,000 JPY (3rd and After)
Old CB				
2007	1st and After (Over 3 years old)	Until PS Graduation	780 (860) million JPY	5,000 JPY (1st and 2nd) and 10,000 JPY (3rd and After)
	Less than 3 years old	-	780 (860) million JPY	10,000 JPY
New CB				
Apr. 2010	1st and After	Until JHS Graduation	-	13,000 JPY
Oct. 2011	1st and After (Over 3 years old)	Until JHS Graduation	-	10,000 JPY
	Less than 3 years old	-	-	15,000 JPY
	3rd and After	Between 3 and 12	-	15,000 JPY

Note: JHS = junior high school, KG = kindergarten, PS = primary school. The thresholds for household income for employees' pension subscribers are between parentheses since they were larger than that for the others.

Here, the policy change of interest is the CB expansion of April 2010. Therefore, this study assumes parents change their attitudes toward the childrearing environment based on the child benefit payment—JPY 13,000 per child until age 15 and graduation from junior high school—and treats the rise in child benefits as an exogenous shock, as in Naoi et al. (2017). In sum, this study estimates the impacts of the CB expansion by using the above variation.

2.2 Free education policy for high school students

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) has implemented a wide variety of enrollment support aimed at reducing education expenses. For example, the FEP was one of the most important and prevalent forms of official support to minimize the financial burden on households, regardless of their financial condition MEXT (2009). This policy was called the Free Tuition at Public High Schools and the High School Enrollment Support Fund, being approved on March 31, 2010, and enforced from April 1, 2010, when the DPJ promoted the Public High-School Tuition Fee Gratuity and High School Support Grant System.

The FEP led to public high-school students being exempted from paying tuition fees. A similar grant based on household income was also offered to all parents with children enrolled in private high schools. Specifically, all parents in Japan were exempt from paying JPY 118,800 per public high school student aged 16-18, while parents with children in private high schools were compensated with JPY 236,000, JPY 178,200, and JPY 118,800 if their household income including tax was below JPY 2.5 million, between JPY 2.5 million and 3.5 million, and above JPY 3.5 million, respectively. As per these policies, high schools received the money on behalf of the students and offset their tuition fees to ensure smooth policy implementation. Therefore, parents were not directly paid, unlike in the case of the CB.

In fiscal year 2013, the amount paid to parents with a child enrolled in a private school was altered to JPY 247,500, JPY 198,000, JPY 148,500, and JPY 118,800 if the household income including tax was below JPY 2.5 million, between JPY 2.5 million and 3.5 million, between JPY 3.5 million and 5.9 million, and between JPY 5.9 million and JPY 9.1 million, respectively. That is, all households that earned less than JPY 9.1 million annually could receive benefits through the FEP since fiscal year 2013. However, this study analyzes the impact of the CB expansion in fiscal year 2010-2011 in terms of the parental attitudes toward the neighborhood environment. Hence, only the benefits from FEP before fiscal year 2012 will be controlled for.

2.3 Monthly benefits from CB and FEP: Examples

The temporal transition of the monthly benefits from the CB and FEP between 2009 and 2013 is illustrated in Figure 2. In these examples, the total payment amounts from both policies are calculated for two children, because the sample for the primary analysis in this study only comprises parents with children under 18 and with two children on average. Monthly payments over the survey period between January and March were used. Chronological variations are shown in red (children under 3 years), blue (ages 3-12), green (ages 13-15), and orange (households over income threshold) for CB, and gray (ages 16-18) for FEP.

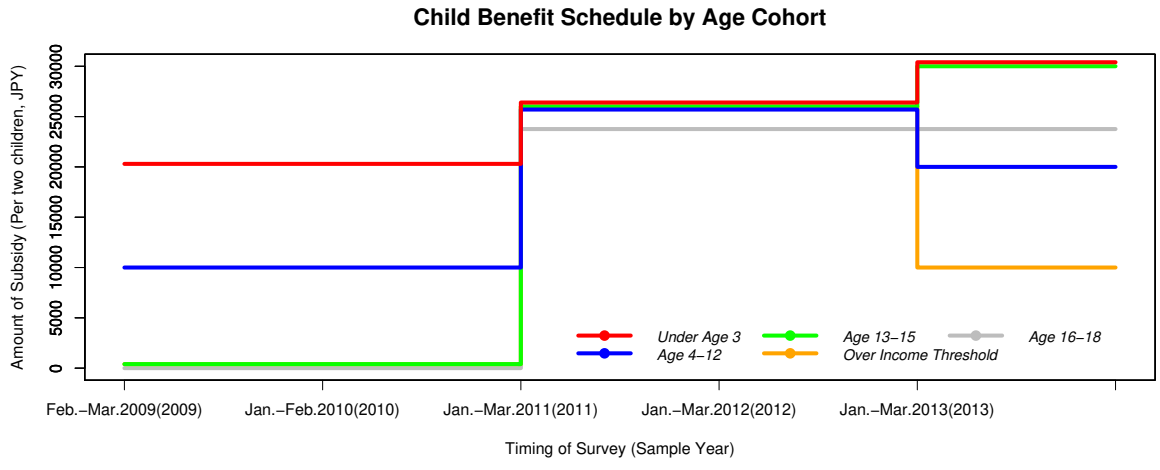

Fig. 2 Temporal Variation of Monthly Child Benefit from fiscal 2009 to 2013

3 Empirical Method and Procedure

The difficulties in inferring the policy impacts of the CB expansion are first presented. In Figure 3, the average priorities of the parents with children aged 0-18, 0-6 (pre-school), 7-12 (elementary school), 13-15 (junior high school), and 16-18 (high school) are represented by the black, red, blue, green, and gray lines, respectively. Here, for each priority, the time trends in the pre-treatment periods seem to differ between parents with and without eligibility, as well as among eligible parents. This could be because the parents with children aged 0-12, as the treatment group, had already received and continued to receive child benefits, unlike the parents with children in other age groups. The control group, comprising parents with a single child in high school, newly received benefits from the FEP. This evidence breaks the common trend assumption. Therefore, the temporal trends are removed by using a standard panel analysis, for example, pooled ordinary least squares (OLS) and FEM.

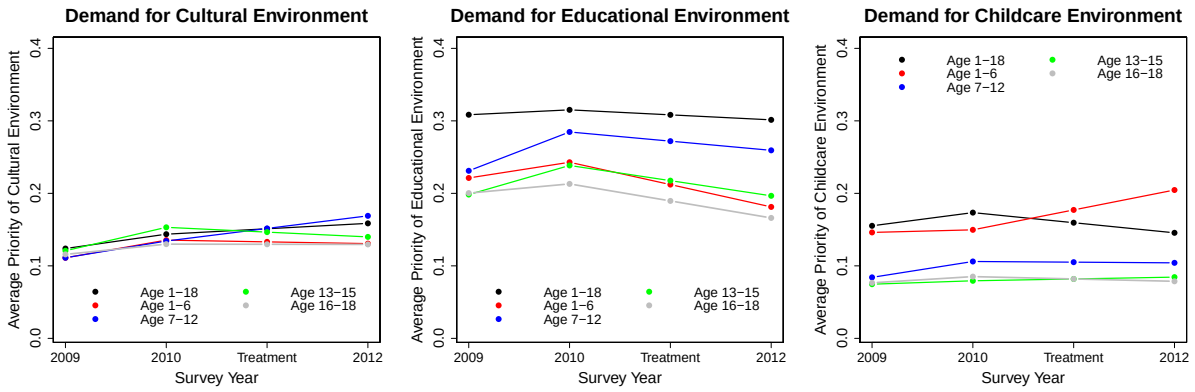

Fig. 3 Temporal Transition in Original Average priorities to Each Living Environment

Here, the panel analysis to estimate the attitude function for newborns and each residential childrearing environment is explained. In panel analyses, researchers usually estimate various models, according to the number of independent variables or types of identification strategies. After the empirical testing, the model that is most suitable in terms of both consistency and efficiency is selected. Accordingly, the model with the smallest variance in consistency is adopted here. The following discussion in this section is based on Croissant and Millo (2008); Firebaugh, Warner and Massoglia (2013); Greene (2003); Wooldridge (2010).

Before describing the estimation methods, the dependent variables used in this study are explained. First, the number of newborns compared to the number of children in fiscal year 2009 is defined as the proxy of parental demand for child quantity. For parental attitudes for living environments, the same proxy variables are used such as the priority to cultural environment (*Culture*), educational environment (*Education*), and childcare environment (*Childcare*), respectively.

The standard pooled OLS is presented first. Let y_{it} be a vector of dependent variables—the priority given to the cultural environment (*Culture*), educational environment (*Education*), and childcare environment (*Childcare*)—and $X_(it)$ be a vector of observable explanatory variables, where z_i and x_{it} are vectors of the time-invariant variable through the sample period and the time-variant variable among X_{it}, respectively. Moreover, the benefits from the CB and FEP normalized to the post-treatment baseline (JPY 13,000 and JPY 11,880 per month) are controlled for. This study uses 4,335 respondents and three periods—2009, 2010, and 2012—for the panel sample. For error terms, let μ_i be an individual fixed effect (FE) of $i \in \{1,2,...,4335\}$, v_t be a time dummy of $t \in \{2009,2010,2012\}$, and ε_{it} be other measurement errors from idiosyncratic effects. Based on the above notation, the pooled OLS can be written as follows:

Pooled OLS

$$\begin{aligned} y_{it} &= a_i z_i + b_{it} x_{it} + \alpha_1 CB_{it} + \alpha_2 FEP_{it} + \mu_i + v_t + \varepsilon_{it} \\ &= a_i z_i + b_{it} x_{it} + \alpha_1 CB_{it} + \alpha_2 FEP_{it} + u_{it} \end{aligned} \tag{1}$$

In Eq. (1), the consistent and efficient estimator of the impact of the CB expansion, represented by α_1, can be derived by standard OLS but only if the orthogonal condition, that is, $E(CB_{it}, u_{it}) = 0$, is satisfied, where u_{it} represents the sum of all error terms and is assumed to be independently and identically distributed (i.i.d.), with mean 0 and variance σ_u^2. This means that estimator α_1 loses consistency if some error terms correlate with the

independent variables, including the CB expansion. Moreover, the estimators lose efficiency unless the error terms causing heteroskedasticity are removed after the independent variables are controlled for. However, the pooled OLS cannot specify which error terms generate heteroskedasticity and should be extracted, since Eq. (1) assumes homoskedasticity for all error terms. The above problem is addressed by using FEM to remove the biases stemming from time- or individual-specific heterogeneity.

Here, let μ_i and v_t be individual and time FEs, respectively. As with the pooled OLS, u_{it} includes all error terms that are not estimated as constant terms. Additionally, let ε_{it} be the idiosyncratic effects not captured by the explanatory variables and that vary with individuals and over time. This study formulates the following three models based on the constant term of only the time FE (i.e., time dummy), only individual FE, and none of them, with the first two being represented by FEM (Time) and FEM (Individual), and assuming that error term u_{it} follows IID $(0, \sigma_u^2)$, which is the same as in the pooled OLS.

FEM Time

$$\begin{aligned} y_{it} &= v_t + a_i z_i + b_{it} x_{it} + \alpha_1 CB_{it} + \alpha_2 FEP_{it} + \mu_i + \varepsilon_{it} \\ &= v_t + a_i z_i + b_{it} x_{it} + \alpha_1 CB_{it} + \alpha_2 FEP_{it} + u_{it}, \end{aligned} \tag{2}$$

FEM Individual

$$\begin{aligned} y_{it} &= \mu_i + a_i z_i + b_{it} x_{it} + \alpha_1 CB_{it} + \alpha_2 FEP_{it} + v_t + \varepsilon_{it} \\ &= \mu_i + a_i z_i + b_{it} x_{it} + \alpha_1 CB_{it} + \alpha_2 FEP_{it} + u_{it}. \end{aligned} \tag{3}$$

As a homoskedasticity test for the error terms is important for selecting the best model between the pooled OLS and FEM, the following model selection procedure is carried out. In conducting a homoskedasticity test, the validity of the pooled OLS assumptions, where all error terms are i.i.d., is examined. If the null hypothesis is rejected, the FEM is adopted. However, which types of FE—time FE, individual FE, and idiosyncratic errors—create heteroskedasticity is yet to be specified. Therefore, a homoskedasticity test is conducted, as proposed by Breusch and Pagan (1979, 1980), who applied the Lagrangian multiplier test to specify the source of heteroskedasticity, and then selected the best model in terms of efficiency from the pooled OLS and FEMs with individual and time FEs.

After ensuring homoskedasticity, more explanatory variables are added, in order, from the more recent variables. Here, it is assumed that the dependent variables have a strong connection with more recent household characteristics than older ones. Hence, the more recent ones are controlled for first and the others are added according to their recency. Next, these models are compared from the viewpoint of the Akaike information criterion (AIC), and the most efficient model is adopted. Finally, this study confirms the significance of the coefficients on the CB and FEP—respectively α_1, α_2 — to classify whether the CB expansion (or the FEP) had causal impacts on the parental priorities to the childrearing environment when individual characteristics are controlled for.

4 Data

This study uses the Preference Parameters Study due to its requirement for large-scale microdata that cover not only a specific individual but also the entire household including children, grandparents, spouses, and parents.[10] The panel survey has been conducted annually since 2003 using a self-administered placement method against a random sample of respondents aged 20-69. For waves 2004, 2006, and 2009, new samples were selected from the Basic Resident Register (in 2003, 2004, and 2006) and a residential map (in 2009) stratified by residential regions and city sizes; these were then combined with the data on previous respondents who continued to take the survey.

Specifically, respondents were asked to respond to the questionnaire during the subsequent survey until they no longer answered the questionnaire or resampling did not occur. In 2006 and 2009, 2,000 and 6,000 individuals were newly and randomly included as study subjects by two-stage stratified sampling, respectively. Of the participants who responded in 2009, this study uses as a sample the 4,335 respondents who continued to respond until 2013. This study mainly uses the data for 2009, 2010, and 2012 from the survey. However, for some time-invariant characteristics—but those that were asked only in 2011 or 2013—the study also refers to the information on these

[10] This survey was conducted under the 21st Century Center of Excellence (COE) Program "Behavioral Macro Dynamics Based on Surveys and Experiments" from 2003 to 2008 and Global COE Project "Human Behavior and Socioeconomic Dynamics" from 2008 to 2013 and from 2016 to 2018 at Osaka University. All survey questionnaires can be accessed at the following https://www.iser.osaka-u.ac.jp/survey_data/survey_eng.html.

periods. In Japan, the fiscal year begins in April, and the survey was conducted from January to March, meaning only the respondents from the 2012 survey can be regarded as the group assigned to the FEP and CB expansion. The study assumes that more recent household characteristics correlate with the dependent variables, as discussed in Section 3. Therefore, the proxy variables reflecting a household's characteristics are chronologically prepared by each generation and explained in the following.[11]

First of all, the CB, which measures treatment impacts, are described. Before fiscal year 2010, only parents with children below the primary school level and with annual household incomes below JPY 7.8 million were paid JPY 5,000 per child for their first and second children and JPY 10,000 per child for every subsequent child or all children under 3 years. the study refers to the existing policy as the old CB. After 2010, all parents with children younger than 15 could be paid JPY 13,000 per month regardless of the household income. This revision is referred to as the CB expansion. Here, the benefits from the monthly payment for an eligible child are normalized so that the total monthly benefits from the CB are divided by the amount of child benefits after fiscal year 2010 (JPY 13,000) for each household and period. Each value is then assigned as CB payment for each household and period. For example, "5/13" is assigned for parents with a treated child aged between 4-12 years before fiscal year 2010. Hence, the magnitude of estimated coefficients can be interpreted as the effects when a parent with a treated child newly comes to receive the expanded CB after April 2010.

Since the FEP is considered to only have an impact on the control group, the exempted tuition fee is evaluated annually and added as an explanatory variable. Specifically, for parents with children in a public high school, the annual benefit was JPY 118,800 per child. For parents with children in private high schools, the annual compensation was JPY 236,000 if their household income with tax was below JPY 2.5 million, JPY 178,200 if the income was between JPY 2.5 million and 3.5 million, and JPY 118,800 otherwise. Before the beginning of FEP, a value of 0 was assigned to all parents, since there was no official support yet. Furthermore, the benefits from FEP for parents with children aged 16 are "not available (NA)" because detailed information about the school type of their children can only be obtained for 2011 and cannot thus be specified for fiscal year 2012. This means that this study can control for the impacts of FEP only for parents with children aged 17-18 that were already attending high school before FEP started in fiscal year 2010.

This study controls the variables reflecting the purchasing power of each household. Initially, total household income is controlled based on the response to "What is your annual household income including tax for the previous year?" JPY 0.8 million is assigned if income was below JPY 1 million, and JPY 1.5 million is assigned if it was between JPY 1 and 2 million; then, the median of each section increased by JPY 2 million, and JPY 20 million was used for an income of JPY 20 million or more, as mentioned in Niimi (2016). Apart from the household income variable, food, eating out, and total household expenditure excluding that on durable goods are also controlled for. Here, all payment types are evaluated as JPY 10,000.

For the current parental characteristics, this study also uses (1) respondent characteristics variables by a dummy that takes 1 if the respondent is male, the number of desired children before the birth of the first child, and dummy indicators of whether the respondent is living in a designated city and with at least a grandparent; (2) a specific area of the education dummy, which takes 1 if the respondent lives in a prefecture with high educational intensity, such as Tokyo, Osaka, Kyoto, and Hiroshima; (3) a Great East Japan Earthquake and radiation dummy, which takes values from 1 to 4 based on the priority to move to another prefecture due to the earthquake itself or due to the fear of radiation effects.[12] Moreover, to understand parental educational history, college graduate and high-school type dummies (1 if they went to national or public schools and 0 if private) are used for both parents.

For the informal educational history of respondents with only pre-school or elementary school education, this study uses their responses to "Which of the following extracurricular activities did you engage in, including what you learned from your parents? Please circle the applicable number." Information is thus gathered on whether they took up swimming, ball games, fighting sports, instrument gymnastics, dance, singing, painting, calligraphy, igo, shogi, language school, print learning, higher cram school, supplementary cram school, or correspondence studies. The corresponding dummy takes 1 if the respondent engaged in that activity.

The study also considers grandparental features. The proxy for the living standards of the grandparents when the respondent was 15 takes values from 0 to 10 and is used for analysis. Moreover, for respondents and their spouses, the dummy variables for whether their mothers had worked as regular or irregular workers when they

[11] A more detailed explanation of each variable is provided in Appendix Tables B-3.

[12] Using the same question on the priority in a living environment, the study attempts to control the impacts of the Great East Japan Earthquake itself and the resulting radiation. These priorities are used for each alternative, "Because there is no need to worry about earthquakes" and "Because there is no need to worry about radiation," which were set only in 2012 and were newly added variables that are scored on a scale of 4 to 0. These are similar to the attitude toward the neighborhood environment and are included in the current parental characteristics.

were 3, 7, and 15 are added to the model as independent variables.

The proxy variables capturing parental attitudes toward the living environment are as follows. The response to a double-layered question is used. The first question is “If you can move another prefecture in Japan, do you hope that? Please write ○ on one if you want and ○ on two if you do not want.” and the second “Why do you want to stay or move in such a prefecture? Please select four important reasons from the following alternative and circle ○ and Write the ranking of 1 to 4 from the most important reasons in the four selected alternatives.”[13] As such, the relevant dummy variable takes 1 for the desire of parents to move, and 0 otherwise. The indicators reflecting the preference priority to each residential environment could be classified as *Culture* from the response to “Because the cultural environment is good (there are many institutions, such as music halls, theaters, libraries),” *Education* from “Because the educational environment is good,” and *Childcare* from “Because there is an adequate number of nursery schools and the childrearing environment is good.” Similar to Contoyannis, Jones and Rice (2004), this study uses a variable that takes 4 for the first place, 3 for second place, 2 for third place, 1 for fourth place, and 0 if not selected. The descriptive statistics are shown in Tables 2 and 3.

5 Results

5.1 Balance test between treated and control groups in the pre-treatment period

This study cannot estimate the true effects of the CB expansion if the dependent variables in the pre-treatment period are potentially different between the treated and control groups. Therefore, before the main analysis, a balance test is conducted for the dependent variables between the groups to confirm whether each one has a statistically significant difference in the pre-treatment period (potential difference). Then, each estimator of the policy impact of the CB expansion is compared to the potential differences between groups. As such, an estimated impact is justifiable if the estimated effect of the CB expansion is far enough from the potential difference.

The Welch’s two-sample t-test is then implemented for a robustness check, even if the true variances differ between groups. This is because not only the number of respondents but also their characteristics might differ among the parents classified by their children’s age cohort; moreover, parents might move to a higher age cohort as their children grow or move down if they have newborns within the sample period. The results of the balance test are provided in Table 4. Columns 1-5 represent the mean of each variable calculated by the four types of treatments on parents whose children were aged 0-15 (full sample), 0-6 (pre-school), 7-12 (primary school), and 13-15 (junior high school), and the control group. The p-values of Welch’s two-sample t-test between each of the four types of treatment and control groups are shown in columns 6-9.

Initially, the p-test was conducted on the pre-treatment difference of the proxies for the living environment between subgroups, divided by the child’s school attainment. Table 4, column 6 confirms that the average attitude toward Childcare can potentially differ. After dividing the treated parents into three subgroups, only the treated parents with at least one primary-school-aged child (ages 7-12) potentially preferred Education more than the control group at the 10% significance level, as per Table 4, column 8. Furthermore, the potential differences in the full sample are generated by the parents with pre-school-aged children (ages 0-6), as per Table 4, column 7.

Prior knowledge reveals the potential differences between the three treatment groups, that is, parents with pre-school-aged children, primary-school-aged children, and junior-high-school-aged children, and the reference group. Hence, this study will compare the estimated average treatment effects of the CB expansion with the potential differences between the treated and control groups to confirm whether the CB expansion, rather than the potential differences between the groups, generated the differences in the estimations of the dependent variables.

[13] The questionnaire is presented in Appendix Table 1.

Table 2 Basic Statistics : Full Sample (Age 0-18)

Statistic	N	Mean	St. Dev.	Min	Max
Priority to Living Environment					
Priority to cultural environment	3,667	0.150	0.606	0	4
Priority to educational environment	3,619	0.402	0.960	0	4
Priority to childcare environment	3,667	0.171	0.648	0	4
Parental Characteristics (Current)					
Free education	3,708	0.011	0.107	0.000	1.500
Child benefit	3,524	0.796	0.808	0.000	5.000
Total household income	3,391	642.557	330.769	80	2,000
Total expenditure per month	3,097	20.516	11.917	1	150
Food expenditure per month	3,437	5.807	3.369	0	60
Eating-outside expenditure per month	3,364	1.374	1.296	0	18
Having a desire to move another prefecture	3,676	0.141	0.348	0	1
Living in a cabinet designed city	3,708	0.270	0.444	0	1
Male	3,708	0.449	0.497	0	1
Number of children	3,620	1.999	0.767	0	7
Number of desired children	3,488	2.258	0.679	0	8
Living with at least a grandparent	2,833	0.213	0.409	0	1
Special area for education	2,833	0.214	0.410	0	1
The great east japan earthquake	2,833	0.023	0.229	0	4
Parental Formal Education History					
University graduation	3,362	0.518	0.500	0	1
University graduation(spouse)	2,996	0.490	0.500	0	1
High school type	3,541	0.754	0.431	0	1
High school type(spouse)	3,541	0.783	0.412	0	1
Parental Extracurricular History (preschool)					
Swimming	3,416	0.061	0.240	0	1
Ball	3,416	0.022	0.146	0	1
Fighting	3,416	0.010	0.101	0	1
Gym	3,416	0.011	0.106	0	1
Dance	3,416	0.021	0.144	0	1
Music	3,416	0.189	0.392	0	1
Sing	3,416	0.004	0.059	0	1
Art	3,416	0.032	0.176	0	1
Penmanship	3,416	0.070	0.255	0	1
Igo	3,416	0.001	0.038	0	1
Shogi	3,416	0.011	0.105	0	1
Language school	3,416	0.020	0.139	0	1
Print learning	3,416	0.020	0.140	0	1
Higher cram school	3,416	0.005	0.070	0	1
Lower cram school	3,416	0.002	0.048	0	1
Corresponding learning	3,416	0.011	0.102	0	1

Table 3 Basic Statistics : Full Sample (Age 0-18)

Statistic	N	Mean	St. Dev.	Min	Max
Parental Extracurricular History (primary school)					
Swimming (primary)	3,416	0.184	0.387	0	1
Ball (primary)	3,416	0.254	0.435	0	1
Fighting (primary)	3,416	0.097	0.297	0	1
Gym (primary)	3,416	0.030	0.169	0	1
Dance (primary)	3,416	0.029	0.168	0	1
Music (primary)	3,416	0.298	0.457	0	1
Sing (primary)	3,416	0.026	0.160	0	1
Art (primary)	3,416	0.058	0.233	0	1
Penmanship (primary)	3,416	0.551	0.497	0	1
Igo (primary)	3,416	0.008	0.090	0	1
Shogi (primary)	3,416	0.033	0.178	0	1
Language school (primary)	3,416	0.081	0.273	0	1
Print learning (primary)	3,416	0.184	0.388	0	1
Higher cram school (primary)	3,416	0.121	0.326	0	1
Lower cram school (primary)	3,416	0.157	0.364	0	1
Corresponding learning (primary)	3,416	0.233	0.423	0	1
Characteristics of Grandparents					
Living Standard at 15 years old	3,669	5.164	1.796	0	10
Mother's labor status (full time [FT]) at age 3	3,541	0.302	0.459	0	1
Mother's labor status (part time [PT]) at age 3	3,541	0.168	0.374	0	1
Mother's labor status (FT) at age 7	3,541	0.338	0.473	0	1
Mother's labor status (PT) at age 7	3,541	0.272	0.445	0	1
Mother's labor status (FT) at age 15	3,541	0.396	0.489	0	1
Mother's labor status (PT) at age 15	3,541	0.370	0.483	0	1
Mother's labor status (spouse, FT) at age 3	3,541	0.269	0.443	0	1
Mother's labor status (spouse, PT) at age 3	3,541	0.165	0.371	0	1
Mother's labor status (spouse, FT) at age 7	3,541	0.299	0.458	0	1
Mother's labor status (spouse, PT) at age 7	3,541	0.238	0.426	0	1
Mother's labor status (spouse, FT) at age 15	3,541	0.339	0.474	0	1
Mother's labor status (spouse, PT) at age 15	3,541	0.303	0.460	0	1

Table 4 Balance Test in Dependent Variables Between Treatment and Control Groups: priority to Each Environment

	Treatment				Control	Difference between			
	Age 0−15	Age 0−6	Age 7−12	Age 13−15	Age 16−18	Full Sample	Subsample		
	(1)	(2)	(3)	(4)	(5)	(1)−(5)	(2)−(5)	(3)−(5)	(4)−(5)
Pre-Treatment									
Priority to cultural environment	0.124	0.12	0.1198	0.1322	0.1207	0.8439	0.9654	0.9568	0.5158
Priority to educational environment	0.2388	0.2291	0.2513	0.2124	0.2048	0.1494	0.3034	**0.0527***	0.7503
Priority to childcare environment	0.1409	0.1474	0.0923	0.0763	0.0796	**0.0002*****	**7.427e-05*****	0.3929	0.8283
Post-Treatment									
Priority to cultural environment	0.1308	0.1307	0.1303	0.1399	0.1296	0.9776	0.9814	0.4019	0.8358
Priority to educational environment	0.2009	0.1813	0.2593	0.1966	0.1661	0.5047	0.7754	**0.0911***	0.5986
Priority to childcare environment	0.1667	0.2046	0.1041	0.0845	0.0787	**0.0351****	**0.0084***	0.4716	0.875

Note: The columns "Treatment" and "Control" show the mean values of three treatment groups and a control group in both the pre- and post- treatment periods. "Difference Between" indicate the p-value of the t-test between the treatment and control groups. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

5.2 Full sample analysis

If the scale of empirical formalization is less than that of a real model, that is, some important explanatory variables are included in the error term, efficiency decreases sharply, although the consistency of estimators is satisfied. In this case, adding more explanatory variables leads to more efficient estimators, thereby thoroughly mitigating omitted variable biases. However, if an excessive formulation occurs and strong multicollinearity arises due to the addition of new explanatory variables, these variables may correlate with the error terms, and the estimators lose consistency. Hence, this study selects independent variables that can be incorporated in the estimation equations from the viewpoint of the scale of the estimation model.

Specifically, excessive- and under-formalization is tested for according to the following procedure. First, current parental characteristics (see Section 4) are considered the primary independent variables and regressed by each dependent variable. Second, adding the other characteristics in Section 4 to these primary variables in chronological order, the robustness in terms of efficiency and heteroskedasticity is tested by comparing the AIC and implementing the Breusch-Pagan (BP) test, respectively. Considering the results of both tests, the model with the largest sample observations without heteroskedasticity is used.

For parents with children aged below 18, that is, the full sample, the more recent variables are added in chronological order to the covariates and regressed by each priority. The results are presented in Tables 5. Specifically, as a basic model, the estimation model is defined with only the current parental characteristics that are controlled for; the corresponding estimators of the CB and FEP are shown in column 1. Next, the estimators with additional covariates related to parental educational history (i.e., whether the respondent graduated from university or high school) are shown in column 2. The out-of-school activity history of the respondents is considered as extracurricular activities in pre- and primary schools, and these are added to the previous equation; the results are shown in column 3. Finally, the subjective living standard when respondents were 15 and the maternal employment status when the child was 3, 7, and 15 for both the respondent and the spouse are included as explanatory variables. Column 4 presents these estimations for the CB and FEP.

Initially, the heteroskedasticity problem is discussed. From the BP test for each dependent variable, the homoskedasticity hypothesis is accepted only in the model including individual FEs, except in the priority to childcare environment, Table 5 column 1. Therefore, in columns 2-4, the FEM (individual FE) is adopted as the main empirical method. Next, efficiency is discussed. From the AIC viewpoint, the model in column 4 is more efficient than the other models for all dependent variable types. Here, the models with the most efficient estimators are highlighted in blue in Table 5. To deal with the multicollinearity problem, the study regards the model estimated in column 2 as the main estimation model. However, the models in columns 3 and 4 also support the null hypothesis of homoskedasticity, and, therefore, both models are used for robustness checks.

Next, the results in Table 5 are reviewed. These tables show that the CB expansion has significant positive impacts on *Childcare* (0.08 0.084). The magnitude of this coefficient denotes that parents with children aged less than 15 increase the priority assigned to a childcare environment by around 0.08 on average due to the CB expansion. Considering the pre-treatment differences, it can be concluded that the CB expansion weakly enhances *Childcare* because the pre-difference for *Childcare* is 0.0613.

5.3 Subsample analysis

These overall results could be offset by the heterogeneity in policy impacts between parent cohorts. Hence, parents are divided according to their children's age and the treatment effects compared for each subsample, that is, parents with children aged 0-6, 7-12, and 13-15. These results are shown in Table 6, columns 2-4.

From column 2, the parents with pre-school-aged children enhance their attitudes only for *Childcare* via the CB expansion as well as the above estimations; however, the coefficient (0.171) is larger than that for the full sample. Moreover, the estimated coefficient is sufficiently large to conclude that the CB expansion has a significant positive impact on *Childcare*, compared to the potential difference for *Childcare* (0.0678). This result suggests that estimating the overall treatment effect of the CB expansion conceals the impact on a specific group regarding the benefits from the CB expansion. However, in column 3, the results for parents with only primary-school-aged children show that the treated parents increased their attitude toward *Education* by around 0.15, while no impact is confirmed on the other attitudes. Since this coefficient is significantly larger than the pre-treatment difference of *Education* (0.0465), the impact is significant. Finally, the treatment group of parents with junior-high-school-aged children does not have any impact, as seen in column 4 of the same table.

Table 5 Fixed Effect Model (FEM) with Individual Fixed Effects (FE): Priority to "Cultural Environment", "Educational Environment', "Childcare Environment'

	Dependent variable : *Priority to Cultural Environment*			
	(1)	(2)	(3)	(4)
ChildBenefit	0.017	0.014	0.018	0.018
	(0.018)	(0.021)	(0.021)	(0.021)
Mean Difference		0.0033		
Current parental characteristics	○	○	○	○
Parental formal education history		○	○	○
Parental informal education history			○	○
Grandparental characteristics			○	○
Observations	3,006	2,451	2,373	2,364
Adjusted R^2	0.083	0.087	0.094	0.102
F Statistic	19.252***	13.340***	8.114***	6.610***
AIC	8110	6781.14	6591.66	6566.89
BP Test (Pooled OLS)	2.2e-16***	2.2e-16***	2.2e-16***	2.2e-16***
BP Test (Time FE)	2.2e-16***	2.2e-16***	2.2e-16***	2.2e-16***
BP Test (Individual FE)	0.2631	0.2641	0.2784	0.2924

Note: The Breusch-Pagan test is used to confirm whether to assume the homoskedasticity for all specification types. The P-values of BP test are proposed at the bottom of this table. *Mean Difference* represents the absolute mean differences between groups before 2010, i.e. $E[Culture_{Treated,Before2010}]-E[Culture_{Control,Before2010}]$. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

	Dependent variable : *Priority to Educational Environment*			
	(1)	(2)	(3)	(4)
ChildBenefit	0.029	−0.006	0.002	−0.004
	(0.028)	(0.032)	(0.033)	(0.034)
Mean Difference		0.034***		
Current parental characteristics	○	○	○	○
Parental formal education history		○	○	○
Parental informal education history			○	○
Grandparental characteristics			○	○
Observations	2,973	2,429	2,351	2,341
Adjusted R^2	0.022	0.026	0.026	0.028
F Statistic	5.517***	4.486***	2.832***	2.428***
AIC	5661.04	4650.99	4531.45	4516.62
BP Test (Pooled OLS)	2.2e-16***	2.2e-16***	2.2e-16***	2.2e-16***
BP Test (Time FE)	2.2e-16***	2.2e-16***	2.2e-16***	2.2e-16***
BP Test (Individual FE)	0.4836	0.4879	0.5835	0.5458

Note: The Breusch-Pagan test is used to confirm whether to assume the homoskedasticity for all specification types. The P-values of BP test are proposed at the bottom of this table. *Mean Difference* represents the absolute mean differences between groups before 2010, i.e. $E[Education_{Treated,Before2010}]-E[Culture_{Education,Before2010}]$. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

	Dependent variable : *Priority to Childcare Environment*			
	(1)	(2)	(3)	(4)
ChildBenefit	**0.090*****	**0.080*****	**0.081*****	**0.084*****
	(0.018)	(0.022)	(0.022)	(0.023)
Mean Difference		0.0613***		
Current parental characteristics	○	○	○	○
Parental formal education history		○	○	○
Parental informal education history			○	○
Grandparental characteristics			○	○
Observations	3,006	2,456	2,378	2,368
Adjusted R^2	0.013	0.015	0.015	0.016
F Statistic	3.729***	3.135***	2.083***	1.837***
AIC	5783.23	4911.91	4765.91	4765.97
BP Test (Pooled OLS)	5.3714e-11***	1.2534e-09***	1.5497e-09***	1.4690e-08***
BP Test (Time FE)	4.2539e-11***	1.6437e-10***	2.1161e-10***	2.1670e-09***
BP Test (Individual FE)	0.0129**	0.4711	0.4652	0.4727

Note: The Breusch-Pagan test is used to confirm whether to assume the homoskedasticity for all specification types. The P-values of BP test are proposed at the bottom of this table. *Mean Difference* represents the absolute mean differences between groups before 2010, i.e. $E[Childcare_{Treated,Before2010}]-E[Childcare_{Control,Before2010}]$. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 6 Fixed Effect Model (FEM) with Individual Fixed Effects (FE) (full sample and subsample): Comparison of the Results of the "Priority to Cultural, Educational, and Childcare Environment" depending on the child's age

	Dependent variable: *Priority to Cultural Environment*			
	Full Sample	Subsample		
	Age 0−15	Age 0−6 (Preschool)	Age 7−12 (Primary school)	Age 13−15 (Junior High school)
ChildBenefit	0.014	−0.071	0.007	0.011
	(0.021)	(0.043)	(0.038)	(0.075)
Mean Difference	0.0033	−0.0007	−0.0009	0.0115
Observations	2,451	673	817	633
F Statistic	13.340***	4.632***	4.043***	4.507***
BP Test (Pooled OLS)	2.2e-16***	0.0090**	2.6314e-07**	4.2183e-06***
BP Test (Time FE)	2.2e-16***	0.0041***	6.8898e-08***	8.1396e-07***
BP Test (Individual FE)	0.2641	0.2756	0.2722	0.5132

Note: All columns are estimated by Model (2) which has the largest observations with BP test passed. *Mean Difference* represents the Absolute Difference between groups before 2010, i.e. $\mathrm{E}[Culture_{Treated,Before2010}]-\mathrm{E}[Culture_{Control,Before2010}]$. *p<0.1; **p<0.05; ***p<0.01

	Dependent variable: *Priority to Educational Environment*			
	Full Sample	Subsample		
	Age 0−15	Age 0−6 (Preschool)	Age 7−12 (Primary school)	Age 13−15 (Junior High school)
ChildBenefit	−0.006	0.043	**0.151****	0.071
	(0.032)	(0.060)	(0.061)	(0.109)
Mean Difference	**0.034*****	0.0244	**0.0465***	0.0077
Observations	2,429	674	807	626
F Statistic	4.737***	2.224***	2.418***	2.630***
BP Test (Pooled OLS)	2.2e-16***	3.8878e-05***	7.0956e-05***	0.0002***
BP Test (Time FE)	2.2e-16***	8.9901e-06***	1.2945e-05***	3.9731e-05***
BP Test (Individual FE)	0.4879	0.4404	0.7663	0.4734

Note: All columns are estimated by Model (2) which has the largest observations with BP test passed. *Mean Difference* represents the Absolute Difference between groups before 2010, i.e. $\mathrm{E}[Education_{Treated,Before2010}]-\mathrm{E}[Education_{Control,Before2010}]$. *p<0.1; **p<0.05; ***p<0.01

	Dependent variable: *Priority to Childcare Environment*			
	Full Sample	Subsample		
	Age 0−15	Age 0−6 (Preschool)	Age 7−12 (Primary school)	Age 13−15 (Junior High school)
ChildBenefit	**0.080*****	**0.171*****	−0.005	−0.068
	(0.022)	(0.054)	(0.029)	(0.043)
Mean Difference	**0.0613*****	**0.0678*****	0.0127	−0.0032
Observations	2,456	673	823	640
F Statistic	3.147***	2.165***	1.319	1.380
BP Test (Pooled OLS)	1.1903e-09***	0.6558	0.3424	0.0674*
BP Test (Time FE)	1.8885e-10***	0.4788	0.3949	0.1045
BP Test (Individual FE)	0.4711	0.5587	0.2335	0.0968*

Note: All columns are estimated by Model (2) which has the largest observations with BP test passed. *Mean Difference* represents the Absolute Difference between groups before 2010, i.e. $\mathrm{E}[Childcare_{Treated,Before2010}]-\mathrm{E}[Childcare_{Control,Before2010}]$. *p<0.1; **p<0.05; ***p<0.01

Furthermore, this study divides respondents into above and below the mean in terms of household income, and it clarifies whether impacts of the CB expansion differ between higher- and lower-income households (Table 7).[14] Table 7 shows that, in the higher-income households, only parents with elementary-school-aged children give higher priority to educational environment by about 0.16 and lower priority to childcare environment by 0.1. For respondents below the mean household income, parents with pre-school students give higher priority to childcare environment by about 0.28.

Overall, the CB expansion prompted the parents with children aged 0-6 only to enhance their attitude toward the childcare environment and the number of children. However, parents with children aged 7-12 were induced to enhance their attitudes toward a better educational environment. There was no significant impact on attitudes for the parents with children aged 13-15 only. Moreover, by dividing parents into higher- and lower-income households, this study concludes that the CB expansion led higher-income households with older children to pay attention to the educational environment; at the same time, lower income households with younger children increased the level of attention paid to childcare environment. These results suggest that the CB expansion had heterogeneous impacts on parents, according to the children's age and household income.

6 Concluding remarks

This study verified the policy impacts of the CB expansion after fiscal year 2010 on parental attitudes toward the neighborhood environment by using proxy variables such as the priorities to cultural, educational, and childcare environments. The policy impacts were examined by FEM, including individual FE.

Before the main analysis, a BP homoskedasticity test was conducted. The results showed that heteroskedasticity was confirmed unless the individual FE was controlled for. Hence, this study adopted the FEM with individual FE as the main estimation method. The results estimated by the above model showed that the CB expansion led to the parents with children aged 15 years or less to give higher priority to the childcare environment by around 8%. These results were robust even when the potential differences between the treated and control groups were considered.

In the subsample analysis, depending on the children's age, parents with only pre-school children gave higher priority to childcare environment by around 0.17. However, among the parents with children in primary school only, the priority to educational environment was increased by around 0.15. These coefficients are sufficiently large compared with the potential differences between the treated and control groups. Moreover, no impact was confirmed on the priority to childrearing environment by parents with only junior-high-school-aged children (ages 13-15). Therefore, I can conclude that the CB expansion in Japan had different impacts on parents with children aged 12 or younger according to the child's education stage. Moreover, dividing parents by household income at the boundary of the sample mean showed that those in higher-income households increased their priorities toward the educational environment and decreased them toward the childcare environment. However, parents in lower-income households only increased their priorities toward childcare environment. These results are consistent with the findings of Lareau (2003); higher- (lower-) SES households give structured (unstructured) education to their children.

However, using the priorities to three environments as the proxies of parental attitudes toward the neighborhood environment could generate a new source of bias, such as a correlation between dependent variables, that is, simultaneous dependence. For example, parents may assign higher priorities to some living environments after the birth of a child, since these alternatives are adjacent in the survey. Therefore, the robustness of the estimation results is confirmed by clarifying whether the dependent variables mutually correlate. Moreover, simultaneous equation model (SEM) mitigates possible simultaneous dependencies. A more detailed discussion is presented in Appendices A-C.

Because of the current data limitations, this study can be extended in the future as follows. In general, an intertemporal correlation, in which the decisions made in one period affect the ones in the following periods, is a major concern in decision-making processes under standard structural models, such as in Rust (1987). By contrast, this research assumes intertemporal independence for decision making, where the introduction of FEP and the CB expansion are regarded as exogenous shocks for both the treatment and control groups. If parents treated on or after fiscal year 2010 could predict the introduction of FEP and CB expansion and could change their decisions in advance, the results of this study would lose consistency due to the omitted serial correlation for decision making.

[14] Some results cannot pass the F-test because split samples are not enough to test the significance of the parameters of interest. Therefore, I only report results that can pass the F-test in the following.

Table 7 Fixed Effect Model (FEM) with Individual Fixed Effects (FE) (full sample and subsample): Comparison of the Results of the "Priority to Cultural, Educational, and Childcare Environment" between High-Income and Low-Income Households

	Dependent variable: *Priority to Cultural Environment*			
	Full Sample	Subsample		
	Age 0−15	Age 0−6 (Preschool)	Age 7−12 (Primary School)	Age 13−15 (Junior High School)
ChildBenefit (High Income HH)	0.003	−0.127	0.004	−0.079
	(0.033)	(0.082)	(0.062)	(0.105)
Observations	1,229	289	395	340
F Statistic	9.375***	2.469***	2.201***	2.822***
ChildBenefit (Low Income HH)	0.040	−0.020	0.039	0.148
	(0.027)	(0.052)	(0.052)	(0.112)
Observations	1,222	384	422	293
F Statistic	4.236***	3.014***	3.135***	2.361***

	Dependent variable: *Priority to Educational Environment*			
	Full Sample	Subsample		
	Age 0−15	Age 0−6 (Preschool)	Age 7−12 (Primary School)	Age 13−15 (Junior High School)
ChildBenefit (High Income HH)	0.016	0.048	**0.158***	0.104
	(0.050)	(0.116)	(0.095)	(0.149)
Observations	1,208	288	384	335
F Statistic	3.027***	1.882**	1.847**	2.414***
ChildBenefit (Low Income HH)	−0.023	0.039	0.127	0.062
	(0.043)	(0.070)	(0.087)	(0.168)
Observations	1,221	386	423	291
F Statistic	2.385***	1.283	1.514*	0.967

	Dependent variable: *Priority to Childcare Environment*			
	Full Sample	Subsample		
	Age 0−15	Age 0−6 (Preschool)	Age 7−12 (Primary School)	Age 13−15 (Junior High School)
ChildBenefit (High Income HH)	0.019	−0.062	**−0.103****	−0.088
	(0.028)	(0.076)	(0.044)	(0.065)
Observations	1,235	292	399	346
F Statistic	2.199***	1.452	1.965***	1.392
ChildBenefit (Low Income HH)	**0.152*****	**0.284*****	0.086**	−0.029
	(0.034)	(0.079)	(0.043)	(0.052)
Observations	1,221	381	424	294
F Statistic	2.005***	1.911**	0.956	0.985

Note: All columns are estimated by Model (2), which has the largest number of observations that have passed the Breusch-Pagan (BP) test. "*High- (Low-) Income HH*" refers to those households whose income is above (below) the mean of each subgroup. *$p<0.1$; **$p<0.05$; ***$p<0.01$

In this regard, it is necessary to verify the validity of the assumptions by using longer sample periods.

Overall, the universal and unconditional cash transfers via the CB expansion had a significant impact on treated parents with children younger than 13 years old. However, the effects on the attitude toward the childrearing environment qualitatively differed according to the children's age. This result implies that, based on not only the children's age but also household income, parents had different reactions to the sudden income gain from the CB expansion. In this case, the child benefit amount for lower-income households with pre-school-aged children should increase when the government hopes to enhance parental attitudes toward environments with rich childcare facilities. However, the government should provide more child benefits for higher-income households with primary-school-aged children to encourage parents to attach a higher priority to the educational environment; in any case, this policy can address the gaps in the opportunities for outside-school education between higher- and lower-income households. Both policies are compatible if the government secures a sufficient budget for childrearing households. Hence, the government should distribute the budget so the opportunity gaps do not widen, depending on the SES.

In conclusion, the results have an important policy implication: financial support from the government without any conditions, such as child benefit, has heterogeneous impacts on the parental attitudes toward the neighborhood environment according to the children's age and household income; as such, the government should carefully choose the target households to achieve its policy goals.

Appendix

Appendix A: Definition of attitude considering the number of children

How did the CB expansion affect the birthrate? Unfortunately, the utilized survey does not include a question on whether the respondent has recently given birth; however, it collected information on the number of children in a household. Therefore, the approximate number of newborns can be derived for each respondent by the difference in the number of children within the same household between successive surveys. However, the number of newborns in fiscal year 2009 cannot be considered because the analyzed data were first collected in fiscal year 2008. Hence, the number of newborns in the pre-treatment period (based on the differences between fiscal years 2010 and 2009) and post-treatment period (based on the differences between fiscal years 2012 and 2011) are calculated, and the number of newborns in fiscal year 2009 is considered as not available or NA. This means I do not have enough information to verify whether the trend holds because the survey covers only a two-year sample period before the CB expansion. Hence, I present the results on newborns as supportive evidence. The summary statistics are provided in Appendix Table 5.

Appendix B: Validity test for the dependent variables

The study confirms and discusses the dependent variables defined in the previous sections. To this end, these variables are compared with the variables that capture the level of extra income spent on children, that is, number of children, total household income, total household expenditure excluding that on durable goods, and expenditure on food and eating out. Appendix Table 6 shows the differences in the p-values of the Pearson's correlation tests between proxies and control variables.

Row 1 in Table 4 shows that all dependent variables are significantly correlated with the actual number of children. However, only the attitude toward the cultural environment (*Culture*) has a negative correlation with the number of newborns (*Newborn*), while the attitudes toward the other environments are positively correlated with this variable. These results suggest that*Culture* is a proxy variable qualitatively different from the others.

Household income and total monthly expenditure have coefficients similar to those of the dependent variables (Appendix Table 6, rows 2 and 3). These results imply that higher-income households prefer *Culture* and *Education* and are less likely to have newborn children, thus expressing a preference for *Childcare*, while the reverse is true for lower-income households. Further, the expenditure on food and eating out is positively correlated with *Culture* and negatively correlated with *Childcare*. Overall, the proxies show significant correlations with the necessary components for childrearing and exhibit mutually different features. Therefore, the validity of the dependent variables used is confirmed.

Appendix C: Robustness test

To test the robustness of the results, omitted variable biases (except for FEP) are addressed through the unobserved effects between the number of newborns and each factor on the attitudes toward the neighborhood environment. Biases, if any, would offset the causal income effects of the CB expansion on child education as a substitution effect.
Specifically, the parameters that directly capture the existence of newborns and the attitudes toward the neighborhood environment might vary over time if the degree of the correlations between attitudes are altered by omitted exogenous shocks, for example, the accessibility expansion to nursery schools (see Asai, Kambayashi and Yamaguchi (2015); Fukai (2017)) and the Great East Japan Earthquake (Hanaoka, Shigeoka and Watanabe (2018)). These omitted variable biases cannot be directly tested and controlled for because the available resources for children vary by household. Moreover, survey questionnaires, in general, cannot capture them completely. As such, efficient estimators cannot be acquired without controlling for simultaneous dependencies not only within attitudes but also between one of the attitudes and newborns if statistically significant; these correlation coefficients vary over time, particularly between the pre- and post-treatment periods. Specifically, by applying the SEM to the standard FEM, the omitted variable bias caused by the correlations between dependent variables—simultaneous dependencies—can be mitigated.

In addition to the standard panel analysis in Section 3, the substitutive effects of omitted fluctuations are removed by directly controlling for simultaneous dependencies. As such, the spatial auto-regressive model is introduced in addition to the standard panel analysis. This method can control for the simultaneous spatial dependencies captured by spatial weight matrix W in Greene (2003) or LeSage and Pace (2009). Using the same notation as in Section 3, the spatial auto-regressive model with temporal variation can be expressed as:

Spatial Auto-Regressive Model (with Temporal Variation)

$$y_{it} = \chi W y_{it} + X_{it}\beta_i + \varepsilon_{it}, \tag{4}$$
$$(I_{it} - \chi W) y_{it} = E(y_{it}) = X_{it}\beta_i + \varepsilon_{it}, \tag{5}$$
$$y_{it} = (I_{it} - \chi W)^{-1} X_{it}\beta_i + (I_{it} - \chi W)^{-1}\varepsilon_{it}. \tag{6}$$

Based on Eqs. (4)-(6), simultaneous dependencies can be removed. χ captures the parameters measuring the strength of simultaneous dependencies and β represents the correlations between the dependent and independent variables. Moreover, W reflects the weight of simultaneous dependencies, which take 1 for other priorities to a respondent and 0 for all priorities between respondents; the weight is exogenously given for each period, as in the literature (see Greene (2003); LeSage and Pace (2009)). Based on the above assumptions, this study allows only intertemporal weight fluctuations, not from past variables but from exogenous shocks, regardless of whether these are observable or not. Therefore, Eq. (4) is an analogy for the typical SEM. Hence, the temporal spatial auto-regressive model can be regarded as an SEM. Overall, the consistent estimator of $(I_{it} - \chi W)^{-1} X_{it}\hat{\beta}_i$ can be estimated by Eq. (6) if the value of $(I_{it} - \chi W)^{-1}\hat{\varepsilon}_{it}$ approximately converges to zero.

As in Section 3, SEM can be defined by applying the same notation as in Eqs. (2) and (3). Similar to LeSage and Pace (2009), this study explicitly assumes the structure of the correlation between the dependent variables $Newborn_{it}$, $Culture_{it}$, $Education_{it}$, and $Childcare_{it}$, which are represented by y_{sit}, s$\in \{1,2,3,4\}$. Assuming that the error terms between equations are ε_{mit} and $\varepsilon_{n(\neq m)it}$, where m, n $\in 1,2,3,4$, correlation coefficients rho_{mn} are directly estimated and simultaneous dependencies are controlled for. Regarding the error terms, it is assumed that they are 0 not only between respondents but also across time. This is equivalent to assuming that, except for the serial correlations, all intertemporal variations in the correlation coefficients are generated by omitted variables. Therefore, the SEM can be formulated as follows:

Simultaneous Equation Model (SEM)

$$\begin{pmatrix} Newborn_{it} \\ Culture_{it} \\ Education_{it} \\ Childcare_{it} \end{pmatrix} = \begin{pmatrix} \alpha_{11}CB_{it} + \alpha_{21}FE_{it} + \delta_1 y_{2it} + \delta_2 y_{3it} + \delta_3 y_{4it} + \theta_1 X_{it} + \varepsilon_{1it}(\varepsilon_{2it}, \varepsilon_{3it}, \varepsilon_{4it}) \\ \alpha_{12}CB_{it} + \alpha_{22}FE_{it} + \delta_4 y_{1it} + \delta_5 y_{3it} + \delta_6 y_{4it} + \theta_2 X_{it} + \varepsilon_{2it}(\varepsilon_{1it}, \varepsilon_{3it}, \varepsilon_{4it}) \\ \alpha_{13}CB_{it} + \alpha_{23}FE_{it} + \delta_7 y_{1it} + \delta_8 y_{3it} + \delta_9 y_{4it} + \theta_3 X_{it} + \varepsilon_{3it}(\varepsilon_{1it}, \varepsilon_{2it}, \varepsilon_{4it}) \\ \alpha_{14}CB_{it} + \alpha_{24}FE_{it} + \delta_{10} y_{2it} + \delta_{11} y_{3it} + \delta_{12} y_{4it} + \theta_4 X_{it} + \varepsilon_{4it}(\varepsilon_{1it}, \varepsilon_{2it}, \varepsilon_{3it}) \end{pmatrix} \tag{7}$$

Are the estimated treatment effects of the CB expansion biased by omitted variables? To answer this question, SEM is used to assess whether the correlation degrees between dependent variables—that is, simultaneous dependencies—are significant in the above FEM (individual FE) results and whether they vary over time.

Here, the correlation coefficients between the residuals estimated by FEM (individual FE) are tested using Pearson's correlation coefficient test. The results are shown in Appendix Table 7, columns 1-3. $Culture_{it}$ and $Education_{it}$ have a positive correlation coefficient, significant throughout the sample period. Furthermore, $Childcare_{it}$ has a significant positive correlation with both $Education_{it}$ and $Newborn_{it}$ but only in fiscal year 2012. Welch's t-test clarifies whether these simultaneous dependencies vary over time. From the p-values of the test in Appendix Table 7, columns 4-6, no serial correlation in the correlation coefficients between proxies can be confirmed. From the above discussion, using SEM improves efficiency by mitigating simultaneous dependencies.

Next, the SEM results are presented. The estimators of the degree of simultaneous dependencies represented by $\delta_{1\ 12}$, and the policy impacts of the CB expansion and FEP introduction, respectively represented by α_1 and α_2 are shown in Appendix 8 -11. For the full sample, the CB expansion had a positive impact on $Newborn_{it}$ (0.0505) at the 1% significance level and $Childcare_{it}$ (0.0314) at the 10% level (see Appendix Tables 8 -11, column 2). However, the SEM shows reverse correlations between Newborn and Childcare, so that the coefficient increases (decreases) for $Newborn_{it}$ (for $Childcare_{it}$) compared with the FEM results. When considering the pre-treatment difference in $Childcare_{it}$ and $Newborn_{it}$ between the treated (0.0833) and control groups (0.0121), it can be concluded that the CB expansion had a significant positive impact on $Newborn_{it}$ only.

However, there are concerns that these overall results are offset by the heterogeneity in policy impacts within the parents' cohort. Hence, parents are grouped according to their children's ages and the treatment effects of each resulting subsample are compared, that is, among parents with children aged 0-6, 7-12, and 13-15. The results are shown in columns 3-5, respectively. Column 3 indicates that parents with pre-school children show increases in the parental attitudes for $Childcare_{it}$ and $Newborn_{it}$ only due to the CB expansion, as well as the above estimations; however, both coefficients are larger than that for the full sample. Moreover, the estimated coefficients are sufficiently large to conclude that the CB expansion had a significant positive impact on $Childcare_{it}$ and $Newborn_{it}$ compared with the potential difference (0.0678 and 0.0237). This suggests the possibility that estimating the overall treatment effect of the CB expansion conceals the impact on a specific group among all samples that benefitted from the CB expansion. Moreover, deeper insights about the differences in the proxies of $Childcare_{it}$ and $Newborn_{it}$ are obtained. In terms of treatment effects, a parent in this subgroup is more likely to give birth (0.1753) than enhance his/her attitude toward the childcare environment (0.1095). This implies that parents do not always take a keen interest in the childcare environment, even if they have more children. However, column 4, which shows the results for parents with primary-school-aged children only, indicates that the treated parents improved their attitude toward Education by around 8.6%, while no impact was confirmed for the other attitudes. Since this coefficient is larger than the pre-treatment difference (0.0465), this impact is sufficiently large. Finally, there is no impact on the treatment group of parents with junior-high-school-aged children only, as seen from column 5.

The analysis proceeded from FEM to SEM. As a result of the correlation test using the residuals estimated by FEM (individual FE), the attitudes toward the cultural and educational environments were shown to have had positive and significant correlations throughout the sample periods, and the attitude toward childcare was significantly correlated with the attitude toward the educational environment and number of newborns, but only in fiscal year 2012. These results confirm that exploiting the SEM mitigates the omitted variable biases stemming from the correlations between the dependent variables.

Appendix D: Appendix Figures and Tables

Appendix Table 1 Questionnaires for Dependent Variables

Questionnaires	
Questionnaire 1	" If you can move another prefecture in Japan, do you hope that? Please write ○ on one if you want and ○ on two if you do not want. "
Questionnaire 2	"Why do you want to stay or move in such a prefecture? Please select four important reasons from the following alternative and circle ○ and Write the ranking of 1 to 4 from the most important reasons in the four selected alternatives."

Appendix Table 2 Definitions for Each Variable

Variable	Definition
Priority to Living Environment	
Priority to cultural environment	The order which takes 4 to 1 where the household prefers a **cultural environment** with the rank of 1 to 4 in Questionnaire 2
Priority to educational environment	The order which takes 4 to 1 where the household prefers an **educational environment** with the rank of 1 to 4 in Questionnaire 2
Priority to childcare environment	The order which takes 4 to 1 where the household prefers a **childcare environment** with the rank of 1 to 4 in Questionnaire 2
Parental Characteristics (Current)	
Free education	Annual payments from FEP of the household / Normal annual amount of FEP per child (118,800 JPN)
Child Benefit	Monthly payments from CB of the household / Normal monthly amount of CB per child (13,000 JPN)
Total household income	0.8 million JPY if the household income is less than 1 million yen 1.5 million JPY if the household income places between 1 and 2 million JPY ... Medians in each income band climbing up by 2 million JPY if the household income places between 2 and 20 million JPY 20 million JPY if a household income is over 20 million JPY
Total expenditure per month	Total Expenditure per month evaluated by ten thousand JPY
Food expenditure per month	Food Expenditure per month evaluated by ten thousand JPY
Eating-outside expenditure per month	Eating-Outside Expenditure per month evaluated by ten thousand JPY
Having a desire to move another prefecture	Dummy variable which takes 1 if the household hopes to move another prefecture
Living in a cabinet designed city	Dummy variable which takes 1 if the household is living in a cabinet designed city (20 cities in Japan)
Male	Dummy variable which takes 1 if the respondent is male
Number of children	Number of Children in each year
Number of desired children	Number of Desired Children in 2009
Living with at least a grandparent	Dummy variable which takes 1 if the household is living with their parent
Special area for education	Dummy variable which takes 1 if the household is living in Tokyo, Osaka, Kyoto and Hiroshima which prefectures have provided any financial supports for parents with a primary or junior high school student before CB expansion started..
The great east Japan earthquake	The order which takes 4 to 1 where the household hopes to move another prefecture due to the earthquake itself or the fear of radiation damage in Questionnaire 2

Appendix Table 3 Definitions for each variable (cont'd)

Variable	Definition
Parental Formal Education History	
University graduation	Dummy variable which takes 1 if the respondent graduated an university
University graduation(spouse)	Dummy variable which takes 1 if the spouse of the respondent graduated an university
High school type	Dummy variable which takes 1 (0) if the respondent graduated a public high school (a private high school)
High school type (spouse)	Dummy variable which takes 1 (0) if the spouse of the respondent graduated a public high school (a private high school)
Parental Extracurricular History (preschool)	
Swimming	Dummy variable which takes 1 if the respondent experienced swimming activity in his/her preschool days
Ball	Dummy variable which takes 1 if the respondent experienced a ball activity (e.g., baseball or soccer) in his/her preschool days
Fighting	Dummy variable which takes 1 if the respondent experienced a fighting activity (e.g., martial arts) in his/her preschool days
Gym	Dummy variable which takes 1 if the respondent experienced an instrument gymnastics in his/her preschool days
Dance	Dummy variable which takes 1 if the respondent experienced dance activity in his/her preschool days
Music	Dummy variable which takes 1 if the respondent experienced a music activity in his/her preschool days
Sing	Dummy variable which takes 1 if the respondent experienced a singing in his/her preschool days
Art	Dummy variable which takes 1 if the respondent experienced a painting in his/her preschool days
Penmanship	Dummy variable which takes 1 if the respondent experienced a calligraphy in his/her preschool days
Igo	Dummy variable which takes 1 if the respondent experienced an igo activity in his/her preschool days
Shogi	Dummy variable which takes 1 if the respondent experienced a shogi activity in his/her preschool days
Language school	Dummy variable which takes 1 if the respondent went to a language school in his/her preschool days
Print learning	Dummy variable which takes 1 if the respondent learned by using print materials in his/her preschool days
Higher cram school	Dummy variable which takes 1 if the respondent went to higher cram school in his/her preschool days
Lower cram school	Dummy variable which takes 1 if the respondent went to lower cram school in his/her preschool days
Corresponding learning	Dummy variable which takes 1 if the respondent utilized a corresponding learning service in his/her preschool days
Parental Extracurricular History (primary school)	
EXPERIENCE (primary)	Dummy variable which takes 1 if the respondent experienced EXPERIENCE in his/her primary school days

Note: EXPERIENCE means the same kind of variable as Parental Extracurricular History (preschool).

Appendix Table 4 Definitions for each variable (cont'd)

Variable	Definition
Characteristics of Grandparents	
Living Standard at 15 years old	The order of the respondent's living standard which takes 0 (min) to 10 (max) when the respondent was 15 years old
Mother's labor status (Full time[FT]) at age 3	Dummy variable which takes 1 if the respondent's mother worked full time when the respondent was 3 years old
Mother's labor status (Part time[PT]) at age 3	Dummy variable which takes 1 if the respondent's mother worked part time when the respondent was 3 years old
Mother's labor status (FT) at age 7	Dummy variable which takes 1 if the respondent's mother worked full time when the respondent was 7 years old
Mother's labor status (PT) at age 7	Dummy variable which takes 1 if the respondent's mother worked part time when the respondent was 7 years old
Mother's labor status (FT) at age 15	Dummy variable which takes 1 if the respondent's mother worked full time when the respondent was 15 years old
Mother's labor status (PT) at age 15	Dummy variable which takes 1 if the respondent's mother worked part time when the respondent was 15 years old
Mother's labor status (spouse, FT) at age 3	Dummy variable which takes 1 if the spouse's mother worked full time when the spouse was 3 years old
Mother's labor status (spouse, PT) at age 3	Dummy variable which takes 1 if the spouse's mother worked part time when the spouse was 3 years old
Mother's labor status (spouse, FT) at age 7	Dummy variable which takes 1 if the spouse's mother worked full time when the spouse was 7 years old
Mother's labor status (spouse, PT) at age 7	Dummy variable which takes 1 if the spouse's mother worked part time when the spouse was 7 years old
Mother's labor status (spouse, FT) at age 15	Dummy variable which takes 1 if the spouse's mother worked full time when the spouse was 15 years old
Mother's labor status (spouse, PT) at age 15	Dummy variable which takes 1 if the spouse's mother worked part time when the spouse was 15 years old

Appendix Table 5 Basic Statistics : Full Sample (Age 0-18)

Statistic	N	Mean	St. Dev.	Min	Max
Number of Newborn	2,212	0.052	0.236	0.000	3.000

Note: Number of Newborn was defined as the difference in the number of children between 2009-10 and between 2011-12. We assigned NA for Newborn in 2009 since we have no data before 2008

Appendix Table 6 The Validity Test for Each Proxy Variables

	The correlation coefficient			
	Culture	*Education*	*Childcare*	*Newborn*
Number of children	$-$**0.0643*****	**0.0539*****	**0.0362*****	**0.2007*****
Household income	**0.0603*****	**0.0728*****	$-$**0.0196***	$-$**0.0700*****
Total expenditure	**0.0661*****	**0.0549*****	-0.007	$-$**0.0450****
Food expenditure	**0.0309*****	-0.0014	$-$**0.0227***	-0.0312
Eating-outside expenditure	**0.0398*****	0.0072	$-$**0.0235****	-0.0320

Note: The significance of each coefficient is tested by Pearson's Product Moment Correlation Coefficient. Newborn, the proxy of the parental demand for child's quantity, is used for the analysis in the Appendix. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Appendix Table 7 Correlation Coefficients Between Dependent Variables in each periods

	Correlation Coefficients Between Dependent Variables in each periods			*P value of Difference Between*		
	2009	*2010*	*2012*	*2009−2010*	*2010−2012*	*2009−2012*
Culture - Education	$\rho_{12,2009}$: **0.1239*****	$\rho_{12,2010}$: **0.0730****	$\rho_{12,2012}$: **0.0772****	0.4727	0.9522	0.5065
Culture - Childcare	$\rho_{13,2009}$: -0.0423	$\rho_{13,2010}$: -0.0139	$\rho_{13,2012}$: -0.0425	0.369	0.3631	0.994
Education - Childcare	$\rho_{23,2009}$: 0.0452	$\rho_{23,2010}$: 0.0085	$\rho_{23,2012}$: **0.1017*****	0.5037	0.1823	0.4466
Culture - Newborn	$\rho_{14,2009}$: -	$\rho_{14,2010}$: 0.0254	$\rho_{14,2012}$: -0.0377	-	0.2681	-
Education - Newborn	$\rho_{14,2009}$: -	$\rho_{14,2010}$: 0.0360	$\rho_{14,2012}$: -0.0465	-	0.1624	-
Childcare - Newborn	$\rho_{24,2009}$: -	$\rho_{24,2010}$: -0.0144	$\rho_{24,2012}$: **0.0744****	-	0.1079	-

Note: $\rho_{mn,Year}$ (where, $m(\neq n) \in [1, 2, 3, 4]$, Year $\in$ [2009, 2010, 2012]) means a correlation coefficient between m and n. Each number of 1 to 4 is equivalent to the order of *Culture*, *Education*, *Childcare*, and *Newborn*, respectively. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Appendix Table 8 SEM Estimation : Demand for "Number of Newborn"

	FEM (Individual FE)	Simultaneous Equation Model			
	Full Sample	Full Sample	Subsample		
	Age 0−15	Age 0−15	Age 0−6	Age 7−12	Age 13−15
ChildBenefit	**0.048*****	**0.0505*****	**0.1753*****	0.0042	−0.0007
FreeEducation	−0.094	−0.0452	−0.0642	−0.0161	−0.0409
Mean Difference	0.0121	0.0121	0.0237**	−0.0059	−0.0009
Observations	2,734	1809	519	693	894
Adjusted R^2	0.022	0.0449	0.1258	−0.0069	0.2239

Note:All groups are compared with the control group (Age 16-18) in Model (4).*Mean Difference* represents the Absolute Difference between groups before 2010, i.e. E[$Newborn_{Treated,Before2010}$]−E[$Newborn_{Control,Before2010}$]. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Appendix Table 9 SEM Estimation : Priority to "Cultural Environment"

	FEM (Individual FE)	Simultaneous Equation Model			
	Full Sample	Full Sample	Subsample		
	Age 0−15	Age 0−15	Age 0−6	Age 7−12	Age 13−15
ChildBenefit	−0.008	0.0067	0.0692	0.0194	0.0084
FreeEducation	0.084	0.0795	0.1898	0.2393	0.0410
Mean Difference	0.0115	0.0115	−0.0007	−0.0009	0.0115
Observations	2,726	1809	519	693	894
Adjusted R^2	0.119	0.1002	0.0804	0.0601	0.0706

Note:All groups are compared with the control group (Age 16-18) in Model (4).*Mean Difference* represents the Absolute Difference between groups before 2010, i.e. E[$Culture_{Treated,Before2010}$]−E[$Culture_{Control,Before2010}$]. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Appendix Table 10 SEM Estimation : Priority to "Educational Environment'

	FEM (Individual FE)	Simultaneous Equation Model			
	Full Sample	Full Sample	Subsample		
	Age 0−15	Age 0−15	Age 0−6	Age 7−12	Age 13−15
ChildBenefit	−0.008	−0.0354	0.0441	**0.0867***	0.0667
FreeEducation	0.083	0.0492	0.2857	−0.0400	0.1428
Mean Difference	0.165***	0.165***	0.0244	0.0465*	0.0077
Observations	2,694	1809	519	693	894
Adjusted R^2	0.061	0.0124	0.0348	0.0118	0.0340

Note:All groups are compared with the control group (Age 16-18) in Model (4).*Mean Difference* represents the Absolute Difference between groups before 2010, i.e. E[$Education_{Treated,Before2010}$]−E[$Education_{Control,Before2010}$]. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Appendix Table 11 SEM Estimation : Priority to "Childcare Environment"

	FEM (Individual FE)	Simultaneous Equation Model			
	Full Sample	Full Sample	Subsample		
	Age 0−15	Age 0−15	Age 0−6	Age 7−12	Age 13−15
ChildBenefit	**0.071*****	**0.0314***	**0.1095****	−0.0038	−0.0166
FreeEducation	−0.094	−0.1322	−0.1281	−0.0471	−0.0574
Mean Difference	0.0833***	0.0833***	0.0678***	0.0127	−0.0032
Observations	2,734	1809	519	693	894
Adjusted R^2	0.022	-3.6e-05	-0.0041	−0.0137	−0.0079

Note:All groups are compared with the control group (Age 16-18) in Model (4).*Mean Difference* represents the Absolute Difference between groups before 2010, i.e. $E[Childcare_{Treated,Before2010}]-E[Childcare_{Control,Before2010}]$. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

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