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The Effect of Maternal Employment in Early Childhood on the Child's Later Development

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【Abstract】
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Summary

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Section 1: Objective of Analysis[†]

According to the "14th Basic Survey of Birth Trends, National Survey on Marriage and Births, Summary of Survey on Married Couples" by the National Institute of Population and Social Security Research, the number of children per married couple in 2010 (the number of children a married couple has after their last child is born) was 1.96. The report indicates that the number of children per married couple fell below 2.00 for the first time since the survey was first conducted in 1940. The number of children is declining even among couples who have been in their marriage only for a short period, suggesting that the declining birth rate is continuing.

A continued declining birth rate will lead to a reduced working-age population, which will in turn result in a shortage of labor. One way of solving the problem of the labor shortage is to utilize the potential female workforce. At present in Japan, the employment rate for women peaks from their late 20s to their early 30s. It declines as women enter the age of marriage and childbirth and then picks up again when women are in their 40s and their children have grown up. This trend is depicted by the M-curve and is commonly known. Therefore, as part of the Cabinet Office's "2012 White Paper on Children and Childrearing," the government has introduced targets for raising the continuous employment rate of women at the time they have their first child from 45%,

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the figure in 2012, to 55% by 2017.

However, the gender role attitudes whereby the husband works outside and the wife stays at home remains deeply rooted in Japan, as in maternal affection mythology and three-year-old-child mythology (i.e., "children should be raised by the mother"). This is one factor that inhibits women from participating in the workforce. According to the Organization for Economic Cooperation and Development (OECD) (2012), the wage gap between men and women in Japan was the second largest, behind that of South Korea. In particular, the wage differentials between working mothers and working fathers are large, presenting a very severe situation for working mothers. According to the National Institute of Population and Social Security Research's "14th Basic Survey of Birth Trends, National Survey on Marriage and Births, Summary of the Results of Survey on Married Couples," the percentage of married women who responded "agree completely" when presented with the statement, "it is good for women not to work and to stay at home at least during the child's early years" declined dramatically from 47.9% in 1992 to 17.9% in 2010. However, the combined percentage of married women who answered "agree completely" to the above question and married women who answered "somewhat agree," although it was lower than it had been in 1992, was still very high in 2010—69.5% of the entire sample of married women. This reveals that many couples still do not have a favorable image of mothers working during the child's early years. Matsuda (2005) has examined the attitude that a preschool child is likely to suffer if his or her mother works. Matsuda found that this attitude remains firmly rooted, particularly among the generation that raised children before the 1970s, and that this

attitude fades away in younger generations and among couples in which the wife is working.

Ohinata (2006) discusses the context in which such maternal affection mythology spread in Japan. In addition to the expansion of gender role attitudes in the 1950s and the socioeconomic background during the period of low economic growth in the 1970s that emphasized the role of mothers, Ohinata points out an underlying bias resulting from the introduction of the findings of overseas psychological and pediatrics studies that emphasized the message that the "absence of the mother will negatively impact a child's development." In particular, pediatrics in Japan borrowed heavily from the research results of the British psychiatrist John Bowlby (1951). The World Health Organization (WHO) commissioned Bowlby to conduct a series of studies. Bowlby studied the development of children who had spent time apart from their families in hospitals or care facilities. He reported that the development of these children was considerably delayed compared with children who had not been separated in this way from their families. As one way of explaining this, Bowlby developed the attachment theory (Bowlby, 1969). Attachment here refers to children approaching and seeking contact with specific individuals. Attachment behavior refers in this case to various behaviors shown by children in order to approach and contact these specific individuals. Attachment theory is an attempt to explain both the attachment behavior that sometimes surfaces and sometimes disappears and also the continuous attachment that children and other individuals show toward specific subjects. By clinging to specific individuals, children who have just been born exercise behavior (attachment behavior) in which they

seek others and attempt to be close to others. The reason children of up to three months smile at anyone is they have not yet identified specific individuals to be attached to. After this period, children become shy of strangers and begin to seek attention from only certain individuals. This signifies that these specific individuals have been fixed. Children then show attachment behavior toward these individuals, especially when they feel pain in times of sickness, etc. During infancy, a child's lacking or being deprived of attachment will increase the child's pain and anxiety and will negatively impact the child's development. Bowlby's above findings are discussed in research concerning hospitalism, defined as the negative physical and psychological impact resulting from being sent to a hospital or care facilities. As previously mentioned, the person to whom a child is attached is a specific person, but there is no mention that it must be the mother. However, according to Ohinata (2006), when Bowlby's findings were introduced in Japan, the message that the absence of mothers would negatively impact the child was emphasized above all else. This is considered to be a factor that led to the three-year-old mythology taking root in Japan.

In the National Longitudinal Survey of Youth (NLSY), a US longitudinal follow-up study, Harvey (1999) examined six research findings to determine the impact of a mother's participation in the workforce while her child is less than three years old on the child's development. She points out the lack of consistency in the results—for example, she found that mothers' long working hours during the first three years of the child's life had a slight negative impact on children's academic competence at age seven and their intellectual capacity at age nine. Moreover she found that there was a lack of

correlation with problem behavior, and a rise in income could positively impact a child's development. Sugawara (2005) conducted a follow-up survey in Japan ranging from the time the child was in the womb until the age of 15 or so. Sugawara investigated whether a child's development until age 14 was affected by the mother's returning to work before the child was three years old. The results showed that there was no relationship between a mother's returning to work before the child was three years old and the child's problem behavior and depression tendencies.

In the field of economics as well, particularly in US and Europe, the topic has been discussed from the perspective of mothers' participation in the workforce, and there have been various arguments concerning how maternal employment in early childhood effects the child's educational results through the process of academic competency formation. Based on these research findings, it is noted that by working, a mother has less contact time with her child, and this may deter the child's development. It is also pointed out that by working, a mother can save for the costs of her child's education, allowing her to invest more into the child's education, which could improve the child's development (Baum, 2003; Berger, Hill, and Waldfogel, 2005; Bernal et al., 2008). For example, Baum (2003) analyzed how maternal employment in early childhood effected the child's cognitive development. The results show that a mothers' employment during the first three months of the child's life has a negative impact on the child's cognitive development. On the other hand, the negative effect on cognitive development in children whose mothers participate in the labor market is partially offset by a positive effect on cognitive development in the children of households with increased income

from the mother's participation in the labor market.

As for studies conducted in Japan, Tanaka (2008) used the Japanese General Social Surveys (JGSS) to analyze the impact of a mother's work situation while her child is 15 years old on the child's final academic background. The results showed that in cases where the mother is a non-regular employee or self-employed while her child is 15 years old, her child, whether son or daughter, will have a poorer academic record than in cases where the mother is a full-time housewife. However, in cases where the mother is a regular employee, the tendency is that only the son will have a poorer academic background. The results also showed that daughters of mothers who are regular employees, if they themselves become mothers, tend to also work as regular employees. Tanaka and Yamamoto (2009) used the Japan Parent-Child Survey, which was conducted in the Osaka University 21st Century COE Project, to analyze the impact of maternal employment in infancy and early childhood on the likelihood that the child would be admitted into private or state junior high schools. The results show that maternal employment while the child is in elementary school negatively impacts the likelihood of the child going on to private or state junior high schools, but it shows that maternal employment while the child is under six years old, which includes employment while the child is zero to three years old, has no impact.

Sakamoto (2009) analyzed children's development not only in terms of the impact from the mother but also of how a child's development is affected by household attributes. Specifically, Sakamoto examined whether there was a difference in children's development (academic background attained, first job, physical and psychological pain

scale, and whether the child goes on to have children at an early age) between single parent households or households in which the mother gave birth at a young age and households with no such attributes. Sakamoto conducted this analysis using the Japanese Panel Survey of Consumers, which is conducted by the Institute for Research on Household Economics. Regarding childbirth at an early age, the results revealed that children born of young mothers tended to have poor academic backgrounds and that their first job was highly likely to be non-regular. The results also revealed a high tendency for such children to have children early themselves. Children of single parent households were also revealed to have a tendency toward lower academic achievement. Akabayashi et al. (2012) and Shikishima et al. (2012) used the JCPS, which is conducted by the Joint Research Center for Panel Studies at Keio University, to conduct factor analysis on children's academic competence, sociability, and adaptability. The results showed that maternal employment at the time of the survey had little impact on children's academic competence and sociability at the time of the survey.

However, among the studies conducted in Japan, there are few analyses that shed light on the impact that maternal employment in early childhood (0–3 years old) has on outcomes such as the child's school results. This study makes use of the JCPS, conducted by the Joint Research Center for Panel Studies at Keio University, where academic test results are available. The study then conducts an examination into how maternal employment in early childhood impacts the child's outcomes at the level of elementary school and junior high school (academic test results, problem behavior, prosocial behavior, and QOL). Elementary school and junior high school represent the

period of compulsory education, and virtually all children receive such education. Moreover, by the time they are in elementary and junior high school, children are able to answer questions by themselves regarding academic tests and other aspects of their school life. Therefore, as the first step in investigating the impact of maternal employment in early childhood (0–3 years old) on the child's outcomes, we focused the analysis on children's outcomes during elementary and junior high school education.

Section 2: Data and Analysis Method

1. Data

The data used in this study came from the 2011 and 2012 surveys of the Japan Child Panel Survey (JCPS) conducted by the Joint Research Center for Panel Studies at Keio University. The 2011 Keio Household Panel Survey (KHPS 2011) and the 2012 Japan Household Panel Survey (JHPS 2012) were both conducted in households with children in elementary school grade 1 to junior high school grade 3. It was therefore possible to use the information from both the KHPS and JHPS.[i] Because the KHPS and the JHPS target different subjects, the data were pooled and utilized not as panel data but as cross-section data. In addition, because the surveys are conducted on all children from elementary school grade 1 to junior high school grade 3, they also include children (siblings) from the same households so that information about parents is the same. Furthermore, because the focus was on maternal employment in early childhood, single father households (motherless families) were removed from the sample.

[i] The JCPS is conducted as a supplementary survey to the JHPS and KHPS, in alternate years. It was conducted alongside the KHPS in 2011 and conducted alongside the JHPS in 2012. This study therefore used the KHPS 2011 and JHPS 2012 that coincided with the years of the JCPS survey.

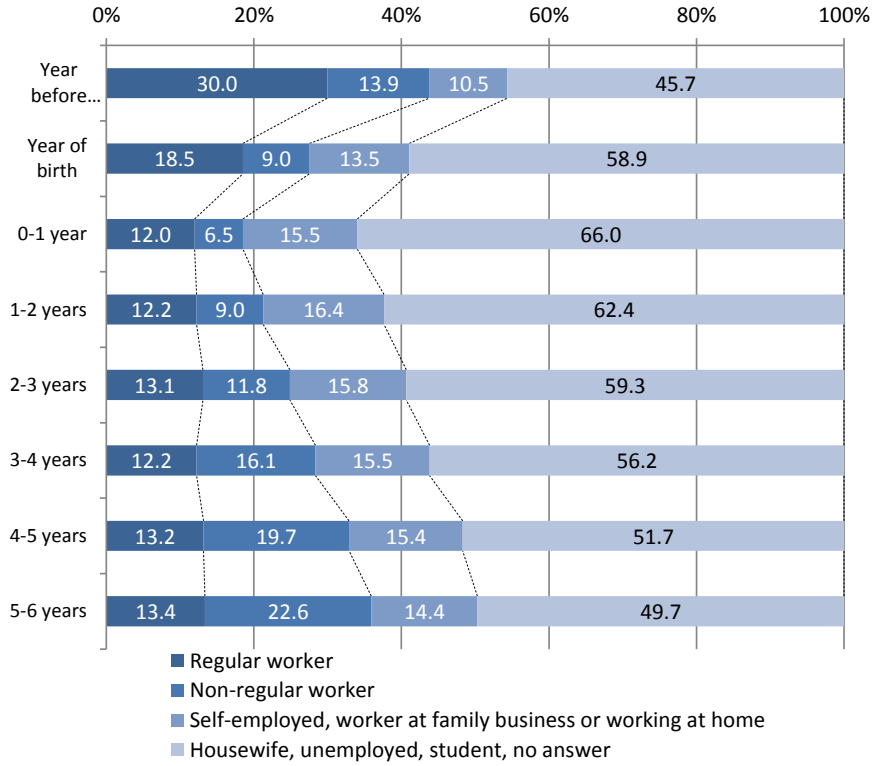
We gathered retrospective data included in the KHPS and JHPS to prepare information on the employment status of mothers during the child's early years. Both the KHPS and JHPS inquired into the forms of employment the study subjects have had in the past. The subjects and their spouses were each asked whether their employment status was "regular worker," "non-regular worker," "self-employed," "worker at family business," or "working at home" after age 18.[ii] This information together with the household information—child's age and mother's age at the child's birth—enabled us to discern for each child the employment status of the child's mother during the child's birth and her employment status after the child's birth. Graph 2-1 shows the change in mother's employment status after each child was born. Because the retrospective data on employment status could only be obtained per year, attention should be paid to the fact that employment status during year of birth fails to discern whether the time period in question was before birth or after birth. Looking at Graph 2-1, we see that the percentage of mothers working in the year before birth was 54.4% but dropped to 41% zero to one year after the child's birth and then steadily began to rise after this. When viewing the data by employment status, the percentage of mothers who were regular employees in the year before they gave birth was 30% of the entire sample, but this figure dropped after that and remained at roughly 13%. This suggests that many of the mothers who were regular employees before giving birth left their employment after giving birth and, furthermore, did not often return to work as regular employees even

[ii] In the retrospective data regarding employment status, there were some cases where the subjects gave two different answers for the same period (for example, "non-regular worker" and "worker for family business"). In such cases, only the status for what was likely the main employment was selected, based on information such as employment status around the time of the survey.

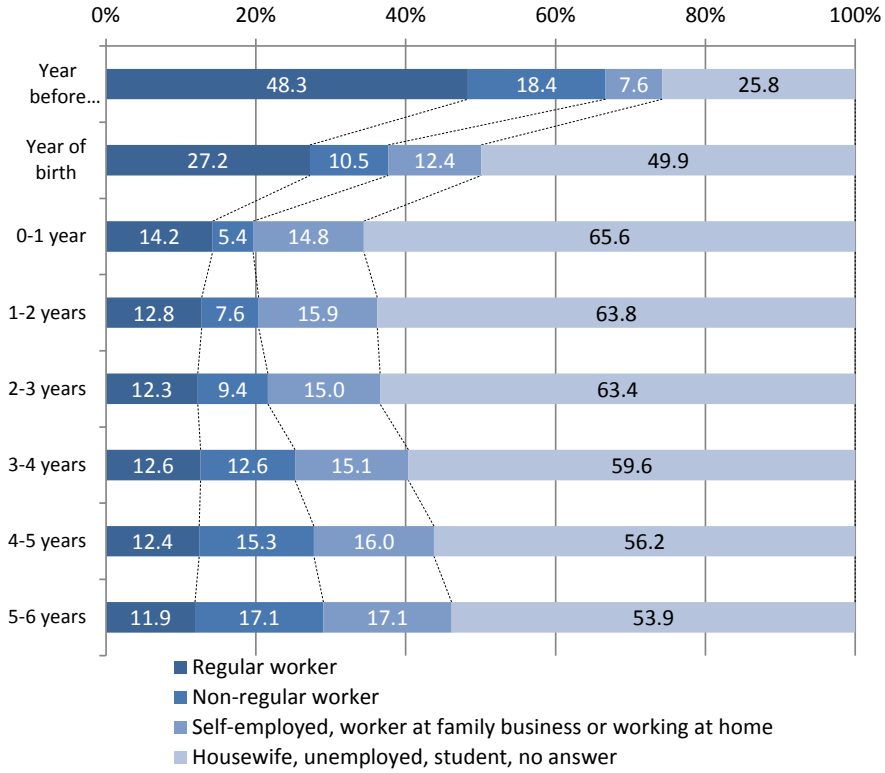
when their children were older. On the other hand, whereas the percentage of non-regular worker fell when the children were zero to one, as the children grew older, the percentage of non-regular worker increased. In the case of self-employment, worker at family business, and working at home, the percentage remained fixed. With self-employment, family business employment, and working from home, there is a high possibility that the mother can work in the same house even after giving birth (for mother's employment status, worker at family business and working at home had particularly high percentages), and as such the percentages for these types of employment did not drop much after the children's births. These tendencies were consistent with the results of the Health, Labour and Welfare Ministry's "9th Longitudinal Survey of Babies in 21st Century (children born in 2001)."

Furthermore, Graph 2-2 shows the change in the employment status of just the mother before and after the first child was born. Compared with Graph 2-1, which includes subjects at the time of the birth of their second child and onwards, we see that the employment rate of mothers after their first child tended to be lower.

Graph 2-1: Change in Mother's Employment Status (n=1,161)



Graph 2-2: Change in Mother's Employment Status (first child only, n = 555)



The data used to show child's outcomes are academic test scores, school's scores as viewed by the parent, index of problem behavior, index of prosocial behavior, and index of quality of life (QOL).

For test scores, the test scores from Mathematics, Japanese language, and Reasoning are used. In this analysis, one point is assigned to each question in each subject (math, Japanese language). The sums of these were standardized so that a mean score both by school grade and by subject would be 50 with a standard deviation of 10. Sum scoring was used for reasoning, because there were only four reasoning questions.

Regarding the school's scores as viewed by the parent, the parents of each child were asked about their child's scores in Japanese language, math, and English language (only junior high school grade 2 and above) for the school year that finished in March. The parents gave answers on a five-point scale ranging from best scores to worst scores. This analysis reversed the scoring so that 5 represented the best scores and 1 represented the worst scores.

The Strengths and Difficulties Questionnaire (SDQ) index is used for problem behavior as viewed by the parent and prosocial behavior as viewed by the parent. The data used for child's problem behavior are the totals of the scores calculated for each of five question items concerning four aspects, which were among the questions that inquired into the state of the child as viewed by the parent. The four aspects are "emotional symptoms," "conduct problems," "hyperactivity/inattention," and "peer problems." On this index, higher scores indicate a greater degree of problem behavior. Questions inquiring into the state of the child as viewed by the parent are also used for

child's prosocial behavior. The index is calculated from five question items such as "kind to younger children," and higher scores indicated higher cooperativeness and empathy.

For a child's QOL, answers given by the children are used (only elementary school grade 3 and above). The scale used was the children-oriented KINDL^{R}, which is a QOL scale that measures children's adaptability (physical and psychological well-being and degree of satisfaction and fulfillment in social relations). The six sub-domains of "physical health," "emotional well-being," "self-respect," "family," "friends," and "school" are used to assess the children's QOL from multiple angles, and the total score for each domain represents the QOL score. On this index, higher scores indicate higher adaptability.[iii]

2 Analysis Method

Regarding the analysis method, we attempted estimations using the following formulas.

$$Y_{ik} = \boldsymbol{X}'_{ik}\boldsymbol{b}_k + \alpha_k H_{ik} + e_{ik} \quad (1)$$

$$H^*_{ik} = \boldsymbol{X}'_{ik}\boldsymbol{\pi}_k + \boldsymbol{W}'_{\boldsymbol{ik}}\boldsymbol{\gamma}_k + u_{ik} \quad (2)$$

$$H_{ik} = \begin{cases} 1(\text{Mother worked at least once during the child's first three years}) \\ 0\ (\text{Mother did not work even once during the child's first three years}) \end{cases}$$

Y_{ik} is child's (i) outcomes (k), and H_{ik} is the employment status of the mother during the child's early years. $\boldsymbol{X}_{ik}$ is the other explanatory variable vector, and $\boldsymbol{W}_{ik}$ is the

[iii] For more details about children's problem behavior and prosocial behavior as viewed by parents, as well as children's QOL, see Shikishima et al. (2012).

explanatory variable vector concerning mother's employment status during the child's early years. Estimation is conducted using ordinary least squares (OLS) and also using the instrumental variables method (IV) and the treatment effect model (TEM). OLS estimated by treating dummy variables that assigned a value of 1 to mothers who worked at least once during their child's first three years of life as exogenous variables and then estimating only Formula (1) above. With IV and TEM, estimates use the dummy variables that assigned a value of 1 to mothers who worked at least once during their child's first three years of life as endogenous variables. There is the possibility of endogeneity emerging in the relationship between maternal employment in early childhood and the child's outcomes. For example, it could also be the case that mothers who work during their children's early years have a high degree of competency, and the children may also be affected by this competency. For this reason, instead of using OLS alone, we also consider endogeneity, and based on that, we conduct first-stage estimation to determine whether a mother is working during the child's first three years of life (H_{ik}) and second-stage estimation to assess the relationship between maternal employment in early childhood and the child's outcomes. The dummy for maternal employment in early childhood is a binary variable, so in the IV method, Formula (2) above, which is the first-stage estimation, is worked out by the linear probability model. For TEM, working out Formula (1) and Formula (2) simultaneously by maximum likelihood estimation enabled more effective quantification. Regarding the instrumental variables, the variables corresponding with $\boldsymbol{W}_{ik}$ are the during the child's first three years, father's employment status, number of siblings, whether the child was left in a

nursery, and the number of working women in the residential area.[iv] The results estimated through OLS, IV, and TEM are used to investigate the impact of maternal employment in early childhood on the child's outcomes.

In order to view the different impacts on the child's outcomes of different types of maternal employment during the child's early years, the case of continuous unemployment during the child's early years (full-time housewife) is set as the reference, and the impact of other types of employment on a child's outcomes is examined. Specifically, 11 categories are used in OLS estimation. These are "mother had continuous regular employment for three years"; "mother had regular employment from the second year"; "mother had regular employment in the third year"; "mother had continuous non-regular employment for three years"; "mother had non-regular employment from the second year"; "mother had non-regular employment in the third year"; "mother was self-employed, worked at the family business, or worked at home continuously for three years"; "mother was self-employed, worked at the family business, or worked at home from the second year"; "and mother was self-employed, worked at the family business, or worked at home in the third year." The IV estimation and TEM that use the 11 categories could not be conducted because the calculation became too complicated. Therefore, the estimation is conducted by OLS only.

In order to examine the impact of household income status on the child's outcomes, income of the household the child belonged to, the mother's income, and the

[iv] The data used are the local female labor participation rate while children are zero to three from the Labour Force Survey. However, because it is not possible to distinguish former residential areas, the data were taken from current residential area.

household's educational expenses are used as explanatory variables $\boldsymbol{X}_{ik}$.[v] In addition, the dummies used are as follows: gender, which assigned girls a value of 1, birth in the last three months of the school year, eldest child, two siblings, three siblings, four or more siblings (one sibling is the reference), child's age, mother's age, mother's university degree, fatherless family, father's university degree, number of students per teacher in the prefecture in which subjects reside,[vi] and JHPS (the descriptive statistics use for the analysis are shown in Table 2-1).

In addition, child's development, child's educational expenses, and mean household income when the mother was continuously unemployed during the child's early years (unemployed [continuously]) are compared with the same data in the case where the mother was not continuously unemployed (Table 2-2). The results reveal that the achievement test results of children whose mothers worked at least once during the first three years of the child's life or had worked continuously as regular or non-regular employees tended to be lower than those of children whose mothers were continuously unemployed. On the other hand, the children of mothers who had worked tend to have higher prosocial behavior and QOL. Educational expenses and household income tend to be higher in cases where the mother had continuous regular employment and in cases where the mother was self-employed, worked at the family business, or worked at home.

[v] This is the total sum spent on each child, which included money for extracurricular activities, school fees, child's allowance (average per month), and other (including end of year gifts).
[vi] This valuable is not dummy and the data used from the School's Basic Survey, which is conducted by the Ministry of Education, Culture, Sports, Science and Technology.

Table 2-1: Descriptive Statistics

	Unemployed during child's early years		Employed during child's early years	
	Mean	SD	Mean	SD
Girl	0.5	0.5	0.5	0.5
Born in the first three months of the year	0.2	0.4	0.2	0.4
Eldest child	0.5	0.5	0.5	0.5
One sibling	0.1	0.3	0.1	0.3
Two siblings	0.5	0.5	0.5	0.5
Three siblings	0.3	0.5	0.3	0.5
Four or more siblings	0.1	0.2	0.1	0.3
Child's age	11.0	2.5	10.8	2.5
Mother's age	41.7	4.9	41.6	5.2
Mother: University degree	0.1	0.4	0.2	0.4
Fatherless family	0.02	0.2	0.1	0.2
Father: University degree	0.4	0.5	0.4	0.5
JHPS	0.4	0.5	0.4	0.5
Number of students per teacher	16.3	2.1	16.2	2.2
During the child's early years				
Day care nursery used	0.05	0.2	0.5	0.5
Father: In regular employment	0.9	0.3	0.8	0.4
Father: Self-employed	0.1	0.2	0.2	0.4
Rate of women working	48.7	2.1	48.9	2.1
One sibling	0.3	0.5	0.3	0.5
Two siblings	0.5	0.5	0.5	0.5
Three siblings	0.1	0.4	0.2	0.4
Four or more siblings	0.02	0.1	0.04	0.2
Sample size	568		476	

Table 2-2: Child's Development, Child's Educational Expenses, and Household Income by Mother's Type of Employment during Child's Early Years (type of employment while the child is aged 0-3, the mean)

	Mother's employment status during child's early years					
	Unemployed (continuously)	Employed	Regular worker (continuously)	Non-regular worker (continuously)	Self-employed, working at family business (continuously)	Other
Variables related to child's development						
Test score: Math*	50.7	49.2 **	48.7 **	50.5	50.3	48.5 ***
Test score: Japanese language	50.5	49.7	48.9	47.1 **	51.6	49.4 *
Test score: Reasoning	2.7	2.7	2.7	2.7	2.8	2.5 **
Sample size	568	476	105	40	133	198
Results as seen by the parent: Math*	3.5	3.4	3.5	3.4	3.5	3.3 **
Sample size	564	473	104	40	133	196
Results as seen by the parent: Japanese language	3.4	3.4	3.3	3.4	3.5	3.3
Sample size	564	472	104	39	133	196
Results as seen by the parent: English language	3.1	3.1	3.2	3.0	3.5 *	2.9
Sample size	177	138	37	15	35	51
Problem behavior (0-30)	8.3	8.4	8.7	7.8	8.2	8.6
Sample size	566	474	105	40	131	198
Prosocial behavior (0-10)	6.1	6.4 *	6.4	6.1	6.6 **	6.3
Sample size	566	474	105	40	131	198
QOL (0-100)	67.5	69.5 **	68.4	71.7 *	69.1	69.8 *
Sample size	432	368	80	32	109	147
Extracurricular activities (average per month: ##yen)	6717	7755	9283 *	6368	7459	7423
School fees (average per month: ##yen)*	11605	13624 *	15114 **	8600	15980 **	12266
Child's allowance (average per month: ##yen)*	897	995	1015	1110	1078 *	905
Other (New Year's gifts etc., average per month: ##yen)	19945	21848	23943 *	27635 *	19468	21167
Sample size	568	476	105	40	133	198
Household income (1 year: ## hundred thousand yen)***	6.9	7.0	8.9 ***	6.7	6.7	6.2 **
Sample size	568	476	105	40	133	198

Note) A "*" symbol next to a numeral denotes the results of testing the difference in average value when compared to the case where the mother is unemployed (continuously.) *** = $p < 0.01$, **= $p < 0.05$, *= $p < 0.1$.

Section 3: Results of Analysis

Table 3-1 shows the IV and TEM estimation results for math test scores. We first look at the test scores for determining whether the maternal employment in early childhood dummy (H_{ik}) is an endogenous variable. Looking at the results of the Wu-Hausman test, it can not be rejected the null hypothesis that H_{ik} is an exogenous variable, and the calculation concerning math test scores suggest the possibility that H_{ik} could be an exogenous variable. On the other hand, although the test statistics are not included,

because the null hypothesis that H_{ik} is an exogenous variable can be rejected in the calculation for Japanese language test scores at a level of 1%, in the reasoning scores at a level of 5%, in the scores for Japanese language as viewed by the parent at a level of 1%, and in the child's problem behavior as seen by the parent at a level of 5%, these statistics suggest that it is highly likely that H_{ik} is an endogenous variable.

Second, we look at the test scores concerning instrumental variables. The conditions for instrumental variables are that there should be partial correlation between endogenous and instrumental variables and no correlation between instrumental variables and error terms in Formula (1). It is possible to use the first-stage F test (H_0: coefficient of instrumental values is 0) to test whether there is a partial correlation between endogenous and instrumental variables. The first stage F test concerning mother's employment during the child's early years is above the standard of 10, so the correlation between instrumental and endogenous variables is not weak, and we judge that these are not weak instruments. We also conduct an overidentification test in order to test the relationship between instrumental variables and Formula (1) error terms. The null hypothesis of the overidentification test is "none of the instrumental variables are correlated with error terms." None of the test results allow this null hypothesis to be rejected. In other words, we understand that the instrumental variables have no correlation with the error terms. The test results concerning the instrumental variables show the same tendency in all of the IV estimations from Table 3-1 onwards. This reveals that it is highly likely that the instrumental variables use in the estimations have the proper attributes of instrumental variables.

Looking at the estimation results concerning maternal employment in early life, which is the first-stage estimation in Table 3-1, mothers who make use of nursery schools are highly likely to be working. On the other hand, the likelihood that the mother worked is lower when the father had regular employment. The likelihood that the mother worked is also lower when there is a second child. The results also reveal that the likelihood that the mother worked is higher when she has graduated from university but is lower in the case of the first child.

Table 3-2 shows the results obtain through OLS shown in Table 3-1 alongside part of the results obtained through IV and TEM. Looking at the Table, we see that when mother's income is taken into account, the difference in continuous unemployment and math scores disappear, but this difference remain with IV and TEM estimation, and the math scores are lower when the mother had worked during the child's early years.[vii]

Table 3-3 shows the results of estimation concerning Japanese language test scores. With OLS, Japanese language test results have no significant difference with continuous unemployment, but when IV and TEM are used, Japanese language test scores are significantly lower. The same can be seen for reasoning in Table 3-4—when endogenous variables are taken into account, children of mothers who worked during the child's early years have significantly lower test scores than do children whose mothers did not work during their early years.

Regarding the impact other variables have on test scores (math), as can be seen in Table 3-1, test scores tend to be lower when the child was born in the last three months

[vii] However, the results of the Wu-Hausman test used for the estimation in the math test results suggest the possibility that maternal employment in early childhood dummy is not an endogenous variable. Therefore, these results should be considered to support the OLS estimation results.

(from January to March) of the school year or had more than three siblings and tend to be higher the older the mother is. The test scores also tend to be higher when both parents had graduated from university. On the other hand, children raise in fatherless families have lower academic test scores. It is understood that there is a tendency whereby the higher the household income, the higher math and Japanese language scores. This confirms that if a household has higher income to invest into greater learning resources, the child of that household will have higher test scores. On the other hand, reasoning scores are not shown to be related to household income.

Table 3-5 shows the coefficients of the dummy variables that assigned a value of 1 when the mother had employment during the child's early years, in terms of the estimations of school's scores as viewed by the parent, problem behavior as viewed by the parent, prosocial behavior as viewed by the parent, and the child's QOL. School's scores as seen by the parent are not related to maternal employment in early childhood, but problem behavior is higher with IV and TEM. Regarding the estimation for child's QOL, whereas QOL is higher when the mother had been employed during the child's early years according to OLS, this result does not significant when IV and TEM are used to take endogenous variables into account.

The above estimation results reveal that maternal employment in early childhood can potentially lower the child's future test scores. Similarly, when dividing maternal employment in early childhood into the 11 categories based on types of employment and then conducting estimation using OLS, the results show that compared with children whose mothers had been continuously unemployed, children of mothers who

had had continuous regular employment from the time they were born have significantly lower test scores. Maternal employment in early childhood has a potentially negative impact on children's development, in particular, their test scores.

Finally, in order to investigate how many school grades this impact extended to, the estimation is conducted separately by school grade group (Table 3-6, Table 3-7.) Table 3-6 shows the coefficients by school grade group (three school grades per group) proper to the employment during the child's first three years dummy. Table 3-7 shows the coefficients by school grade group proper to the dummy when the mother had had continuous regular employment during the child's first three years. The results show that in the lower school grades, academic test scores are negatively correlated with maternal employment in early childhood but that the higher the school grade, the weaker this negative correlation, and the correlation disappear by junior high school. Regarding child's problem behavior, the results of estimation by school grade group also show no significant correlation with maternal employment in early childhood.

Table 3-1: Estimation Results of Math Test Scores (IV, TEM, n = 1,044)

	IV						TEM					
	Math	Mother Employed during child's early years	Math	Mother Employed during child's early years	Math	Mother Employed during child's early years	Math	Mother Employed during child's early years	Math	Mother Employed during child's early years	Math	Mother Employed during child's early years
Mother Employed during child's early years	-2.426**		-2.429**		-2.343*		-2.760**		-2.781**		-2.862**	
	[1.137]		[1.137]		[1.357]		[1.085]		[1.081]		[1.253]	
Child's Gender (girl: 1)	-0.63	0.0428*	-0.622	0.0438*	-0.624	0.0393	-0.611	0.150*	-0.602	0.152*	-0.599	0.154*
	[0.587]	[0.0259]	[0.586]	[0.0258]	[0.586]	[0.0254]	[0.585]	[0.0899]	[0.585]	[0.0901]	[0.585]	[0.0920]
Born in first three months of the year	-2.142***	-0.0152	-2.159***	-0.017	-2.163***	-0.00916	-2.145***	-0.0417	-2.163***	-0.0444	-2.161***	-0.0137
	[0.698]	[0.0306]	[0.697]	[0.0307]	[0.697]	[0.0304]	[0.682]	[0.105]	[0.682]	[0.105]	[0.682]	[0.107]
Eldest	1.149	-0.0941***	1.123	-0.0973***	1.119	-0.0883***	1.127	-0.334***	1.099	-0.345***	1.099	-0.296**
	[0.700]	[0.0345]	[0.703]	[0.0344]	[0.702]	[0.0339]	[0.703]	[0.122]	[0.704]	[0.122]	[0.704]	[0.125]
Two siblings	-1.402	-0.0322	-1.341	-0.0255	-1.338	-0.0153	-1.433	-0.124	-1.372	-0.0999	-1.376	-0.0191
	[0.999]	[0.0561]	[0.999]	[0.0563]	[1.000]	[0.0559]	[1.075]	[0.180]	[1.075]	[0.181]	[1.076]	[0.184]
Three siblings	-2.337**	-0.0373	-2.263**	-0.0276	-2.258**	-0.0136	-2.367**	-0.136	-2.292*	-0.0984	-2.298*	0.0182
	[1.104]	[0.0630]	[1.101]	[0.0632]	[1.103]	[0.0629]	[1.183]	[0.212]	[1.183]	[0.213]	[1.184]	[0.217]
Four or more siblings	-6.158***	0.0379	-6.076***	0.0467	-6.099***	0.0907	-6.150***	0.131	-6.065***	0.169	-6.050***	0.398
	[1.555]	[0.0844]	[1.557]	[0.0844]	[1.560]	[0.0838]	[1.499]	[0.269]	[1.500]	[0.271]	[1.509]	[0.277]
Child's age	-0.284**	0.00755	-0.303**	0.00552	-0.303**	0.00484	-0.286**	0.0255	-0.306**	0.0183	-0.307**	0.0111
	[0.140]	[0.00661]	[0.140]	[0.00661]	[0.140]	[0.00650]	[0.143]	[0.0228]	[0.145]	[0.0232]	[0.145]	[0.0237]
Mother's age	0.232***	-0.00743**	0.229***	-0.00765**	0.230***	-0.00817**	0.231***	-0.0239**	0.229***	-0.0244**	0.228***	-0.0249**
	[0.0811]	[0.00329]	[0.0813]	[0.00329]	[0.0813]	[0.00324]	[0.0739]	[0.0119]	[0.0739]	[0.0119]	[0.0742]	[0.0121]
Mother: University degree	1.876**	0.0703*	1.835**	0.0665*	1.850**	0.0354	1.902**	0.249*	1.861**	0.237*	1.854**	0.117
	[0.780]	[0.0375]	[0.778]	[0.0375]	[0.782]	[0.0370]	[0.840]	[0.128]	[0.840]	[0.129]	[0.845]	[0.135]
Fatherless family	-4.019**	-0.0153	-4.000**	-0.00779	-3.956**	-0.0727	-3.953**	0.0366	-3.930**	0.0705	-3.951**	-0.266
	[1.775]	[0.0766]	[1.773]	[0.0765]	[1.808]	[0.0790]	[1.646]	[0.304]	[1.645]	[0.305]	[1.666]	[0.305]
Father: University degree	2.010***	-0.00733	2.003***	-0.00888	1.993***	0.00896	1.982***	0.00402	1.973***	-0.00443	1.977***	0.0635
	[0.660]	[0.0297]	[0.659]	[0.0296]	[0.656]	[0.0296]	[0.675]	[0.104]	[0.675]	[0.104]	[0.676]	[0.107]
Number of students per teacher	-0.0867	-0.000811	-0.0814	-0.000293	-0.084	0.00339	-0.0901	0.000892	-0.0849	0.00287	-0.0836	0.0239
	[0.154]	[0.00633]	[0.153]	[0.00628]	[0.153]	[0.00622]	[0.145]	[0.0228]	[0.145]	[0.0229]	[0.146]	[0.0236]
JHPS	0.137	0.0226	0.245	0.033	0.244	0.0295	0.154	0.107	0.266	0.141	0.269	0.158
	[0.613]	[0.0268]	[0.620]	[0.0271]	[0.620]	[0.0267]	[0.605]	[0.0940]	[0.614]	[0.0955]	[0.614]	[0.0976]
Household income	0.00305***	0.000092*	0.00293**	0.0001	0.00300**	-0.00002	0.00309***	0.000296*	0.00297***	0.000251	0.00293***	-1.01E-04
	[0.00115]	[0.000048]	[0.00114]	[0.00005]	[0.00123]	[0.00005]	[0.00104]	[0.000159]	[0.00104]	[0.000160]	[0.00113]	[0.000178]
School expenditure			0.00865	0.000863***	0.0086	0.000811***			0.00896	0.00298**	0.00901	0.00294*
			[0.00758]	[0.000281]	[0.00759]	[0.000261]			[0.00804]	[0.00137]	[0.00805]	[0.00151]
Mother's income					-0.00043	0.000632***					0.000265	0.00312***
					[0.00275]	[0.000101]					[0.00289]	[0.000513]
Nursery school		0.571***		0.573***		0.509***		1.843***		1.853***		1.679***
		[0.0264]		[0.0263]		[0.0297]		[0.124]		[0.124]		[0.130]
Father during child's early years: Regular employment		-0.195***		-0.186***		-0.162***		-0.688***		-0.660***		-0.580***
		[0.0599]		[0.0602]		[0.0610]		[0.201]		[0.202]		[0.204]
Father during child's early years: Self-employed		-0.00431		-0.00614		0.00537		0.0395		0.0357		0.0438
		[0.0661]		[0.0661]		[0.0667]		[0.227]		[0.228]		[0.229]
Employment rate of women in the living area		0.00716		0.00805		0.005		0.0251		0.0276		0.0126
		[0.00656]		[0.00654]		[0.00649]		[0.0220]		[0.0221]		[0.0226]
Number of children during child's early years: 2 children		-0.122***		-0.123***		-0.129***		-0.404***		-0.407***		-0.468***
		[0.0382]		[0.0381]		[0.0375]		[0.125]		[0.126]		[0.129]
Number of children during child's early years: 3 children		-0.0733		-0.0827		-0.0776		-0.367		-0.399		-0.352
		[0.0867]		[0.0871]		[0.0855]		[0.322]		[0.322]		[0.326]
Number of children during child's early years: 4 children		0.032		0.0387		0.0128		0.197		0.217		0.0373
		[0.0942]		[0.0947]		[0.0929]		[0.349]		[0.349]		[0.356]
Constant	45.03***	0.421	45.04***	0.37	45.01***	0.48	45.29***	-0.28	45.31***	-0.436	45.35***	-0.0991
	[4.552]	[0.355]	[4.547]	[0.355]	[4.560]	[0.352]	[4.350]	[1.214]	[4.347]	[1.219]	[4.362]	[1.216]
athrho							0.150*		0.149*		0.161*	
							[0.0833]		[0.0830]		[0.0921]	
lnsigma							2.236***		2.236***		2.236***	
							[0.0224]		[0.0224]		[0.0226]	
Wu-Hausman F test	2.116		2.008		1.505							
Overidentification test	1.577		1.59		1.579							
Underidentification test	281.84***		282.28***		203.24***							
First stage F test	103.80***		103.84***		63.50***							
Partial R squared	0.106	0.324	0.107	0.328	0.108	0.349						
LR test (H_0:ρ=0)								3.30*		3.27*		3.11*
Log likelihood								-4336		-4333		-4312

Note: The figure inside the [ ] is the standard deviation. *** = p < 0.01, ** = p < 0.05, * = p < 0.1.

Table 3-2: Estimation Results of Math Test Scores (OLS, IV, TEM, n = 1,044)

	OLS	IV	TEM	OLS	IV	TEM	OLS	IV	TEM
Mother Employed during child's early years	-1.121*	-2.426**	-2.760**	-1.157*	-2.429**	-2.781**	-0.964	-2.343*	-2.862**
	[0.603]	[1.137]	[1.085]	[0.605]	[1.137]	[1.081]	[0.651]	[1.357]	[1.253]
Household Annual income	0.00290**	0.00305***	0.0031***	0.00281**	0.00293**	0.003***	0.00318**	0.00300**	0.0029***
	[0.00114]	[0.00115]	[0.00104]	[0.00114]	[0.00114]	[0.00104]	[0.00124]	[0.00123]	[0.00113]
Educational expenditure				0.00751	0.00865	0.00896	0.00751	0.0086	0.00901
				[0.00770]	[0.00758]	[0.00804]	[0.00775]	[0.00759]	[0.00805]
Mother's income							-0.00228	-0.00043	0.000265
							[0.00237]	[0.00275]	[0.00289]
Child's information	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mother's/father's academic background	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The figure inside the [ ] is the standard deviation. *** = p < 0.01, ** = p < 0.05, * = p < 0.1. The estimations include child's information (girl, born in the last three months of school year, eldest child, two siblings, three siblings, four or more siblings, child's age), mother's and father's academic backgrounds (mother graduated from university, father graduated from university, fatherless family), and area (number of students per teacher, JHPS).

Table 3-3: Estimation Results of Japanese Language Test Scores (OLS, IV, TEM, n = 1,044)

	OLS	IV	TEM	OLS	IV	TEM	OLS	IV	TEM
Mother Employed during child's early years	-0.614	-3.665***	-4.112***	-0.673	-3.697***	-4.084***	-0.332	-3.780***	-4.018***
	[0.594]	[1.142]	[1.133]	[0.596]	[1.144]	[1.130]	[0.643]	[1.389]	[1.300]
Household Annual income	0.0029***	0.00324***	0.0033***	0.0027***	0.00305***	0.0031***	0.0034***	0.00295***	0.00292**
	[0.000949]	[0.000948]	[0.00105]	[0.000958]	[0.000955]	[0.00106]	[0.00105]	[0.00105]	[0.00114]
Educational expenditure				0.0122*	0.0149**	0.0153*	0.0122*	0.0149**	0.0151*
				[0.00675]	[0.00663]	[0.00813]	[0.00676]	[0.00663]	[0.00813]
Mother's income							-0.00402*	0.000601	0.00092
							[0.00226]	[0.00272]	[0.00295]
Child's information	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mother's/father's academic background	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The figure inside the [ ] is the standard deviation. *** = p < 0.01, ** = p < 0.05, * = p < 0.1. The estimations include child's information (girl, born in the last three months of school year, eldest child, two siblings, three siblings, four or more siblings, child's age), mother's and father's academic backgrounds (mother graduated from university, father graduated from university, fatherless family), and area (number of students per teacher, JHPS).

Table 3-4: Estimation Results of Reasoning Test Scores (OLS, IV, TEM, n = 1,044)

	OLS	IV	TEM	OLS	IV	TEM	OLS	IV	TEM
Mother Employed during child's early years	-0.0548	-0.297**	-2.094*	-0.0603	-0.296*	-2.083*	-0.0522	-0.339*	-2.206*
	[0.0814]	[0.151]	[1.133]	[0.0818]	[0.151]	[1.130]	[0.0874]	[0.183]	[1.317]
Household Annual income	0.000169	0.000197	0.00151	0.000155	0.000179	0.00141	0.000171	0.000134	0.00111
	[0.000153]	[0.000155]	[0.00108]	[0.000153]	[0.000155]	[0.00108]	[0.000171]	[0.000171]	[0.00116]
Educational expenditure				0.00112	0.00133	0.00775	0.00112	0.00135	0.00772
				[0.000949]	[0.000966]	[0.00831]	[0.000944]	[0.000985]	[0.00832]
Mother's income							-0.0001	0.00029	0.00182
							[0.000328]	[0.000392]	[0.00300]
Child's information	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mother's/father's academic background	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The figure inside the [ ] is the standard deviation. *** = p < 0.01, ** = p < 0.05, * = p < 0.1. The estimations include child's information (girl, born in the last three months of school year, eldest child, two siblings, three siblings, four or more siblings, child's age), mother's and father's academic backgrounds (mother graduated from university, father graduated from university, fatherless family), and area (number of students per teacher, JHPS).

Table 3-5: Coefficients of Employment during Child's First Three Years Dummy (school results as viewed by the parent, problem behavior, prosocial behavior, QOL)

	OLS	IV	TEM
School's scores as viewed by parent: Mathematics	-0.0496	-0.129	-0.144
	[0.0710]	[0.141]	[0.133]
School's scores as viewed by parent: Japanese language	0.023	-0.135	-0.118
	[0.0641]	[0.130]	[0.124]
School's scores as viewed by parent: English language	0.0635	0.1	0.0184
	[0.142]	[0.282]	[0.307]
Problem behavior	0.103	1.383*	1.344**
	[0.346]	[0.741]	[0.681]
Prosocial behavior	0.0994	-0.224	-0.219
	[0.144]	[0.301]	[0.290]
QOL	1.749*	0.449	-0.54
	[1.001]	[2.261]	[2.032]

Note: The figure inside the [ ] is the standard deviation. *** = p < 0.01, ** = p < 0.05, * = p < 0.1. The estimations include household income, educational expense and mother's income in addition to child's information (girl, born in the last three months of school year, eldest child, two siblings, three siblings, four or more siblings, child's age), mother's and father's academic backgrounds (mother graduated from university, father graduated from university, fatherless family), and area (number of students per teacher, JHPS).

Table 3-6: Estimation by School Grade Group (three grades per group,) Coefficients of Employment during First Three Years Dummy (QOL estimated by OLS, others estimated by IV and TEM)

	IV			TEM			OLS		
School grade	El 1-3	El 4-6	Jun 1-3	El 1-3	El 4-6	Jun 1-3	El 1-3	El 4-6	Jun 1-3
Mathematics	-4.722**	-1.447	-0.768	-3.845*	-3.758	-0.965	-	-	-
	[2.161]	[2.023]	[2.703]	[2.021]	[2.465]	[2.252]	-	-	-
Japanese language	-5.193**	-3.774*	-2.156	-6.744***	-5.533***	-1.175	-	-	-
	[2.213]	[2.222]	[2.508]	[2.263]	[2.003]	[2.512]	-	-	-
Reasoning	-1.003***	-0.201	0.475*	-1.214***	-0.0726	0.356	-	-	-
	[0.331]	[0.284]	[0.288]	[0.322]	[0.282]	[0.255]	-	-	-
Sample size	363	361	320	363	361	320	-	-	-
Problem behavior	0.943	0.741	1.476	1.12	0.429	1.21	-	-	-
	[1.126]	[1.144]	[1.530]	[1.122]	[1.087]	[1.312]	-	-	-
Sample size	362	361	317	362	361	317	-	-	-
QOL	-	-	-	-	-	-	1.205	2.51	1.542
	-	-	-	-	-	-	[2.865]	[1.554]	[1.470]
Sample size	-	-	-	-	-	-	143	344	313

Note: The figure inside the [ ] is the standard deviation. *** = p < 0.01, ** = p < 0.05, * = p < 0.1. The "El" means elementary school; the "Jun" means Junior high school. The estimations include household income, educational expense and mother's income in addition to child's information (girl, born in the last three months of school year, eldest child, two siblings, three siblings, four or more siblings, child's age), mother's and father's academic backgrounds (mother graduated from university, father graduated from university, fatherless family), and area (number of students per teacher, JHPS).

Table 3-7: Overall Estimation by School Grade Group, Coefficients of Regular Employment during Child's First Three Years Dummy (OLS)

	Overall	El 1-3	El 4-6	Jun 1-3
Mathematics	-3.433***	-5.257**	-3.435	-1.471
	[1.278]	[2.145]	[2.556]	[2.035]
Japanese language	-2.729**	-2.908	-5.911*	-0.815
	[1.379]	[2.124]	[3.334]	[1.721]
Reasoning	-0.102	-0.539*	-0.103	0.377*
	[0.169]	[0.276]	[0.389]	[0.223]
Sample size	1044	363	361	320

Note: The figure inside the [ ] is the standard deviation. *** = p < 0.01, ** = p < 0.05, * = p < 0.1. The "El" means elementary school; the "Jun" means Junior high school. The estimations include household income, educational expense, and mother's income, in addition to child's information (girl, born in the last three months of school year, eldest child, two siblings, three siblings, four or more siblings, child's age), mother's and father's academic backgrounds (mother graduated from university, father graduated from university, fatherless family), and area (number of students per teacher, JHPS).

Section 4: Conclusion

This study empirically analyze the impact of maternal employment in early childhood on the child's test scores, the child's results as viewed by the parent, the child's problem behavior, the child's prosocial behavior, and the child's QOL. Conducting IV and TEM analyses that took maternal employment in early childhood into account reveal that maternal employment in early childhood is negatively correlated in particular with the child's test scores. There is an especially strong correlation when the mother had worked continuously as a regular employee during the child's first three years. However, according to the estimation conducted by school grade group (three grades per group), this effect progressively diminish in the higher school grades and the negative correlation disappear by junior high school. Regarding school's scores as viewed by the parent and child's prosocial behavior, there is no significant correlation in the OLS, IV, and TEM tests. Regarding child's QOL, although there is a significant correlation in the OLS test, in the estimation conducted by school grade group as well as in the IV and TEM tests that controlled endogeneity, there is no correlation. Regarding child's problem behavior, the IV and TEM tests show that the scores for problem behavior are higher when the mother had worked during the child's early years, but no such correlation is shown in the estimation conducted by school grade.

These results suggest that maternal employment in early childhood may have a temporary negative effect on the child's school results during lower grades of elementary school education, but that this effect vanishes. Mothers who worked during the child's early years spent more on their child's education for all school grades than

did mothers who were full-time housewives. This suggests that whereas maternal employment in early childhood may have a temporary negative impact on the child's elementary school results, this effect will then be potentially offset by, for instance, the subsequent use of educational resources.

Because this study made use of retrospective data, the analysis is conducted only by the mother's type of employment. However, other factors such as the actual hours of work or the mother's work description during the child's early years are considered to be important factors as well. Furthermore, in terms of whether there was someone other than the mother available to raise the child, there is also a need to investigate situations such as three-generation households, personal networks, and social capital. KHPS has carried out surveys that started in 2004. Apart from the network-related indices, the data concerning children aged seven as of 2011 are available. However, the sample size, at 34, is very small; hence, it is difficult to identify stable tendencies. There is a need to wait for more data to accumulate and then conduct a follow-up analysis.

Moreover, because this study used "the child was left in a nursery" as an instrumental variable, it did not investigate the effects of nursery schools, which also have a hand in child rearing. The instrumental variables used in this study fulfilled the necessary conditions required for instrumental variables used in estimations. However, because it was possible that "using nursery" and mother's employment during the child's early years had simultaneity and "using nursery" had an impact on the child's outcomes, the suitability of the instrumental variables remains in doubt. In addition, there is a need in the future to conduct more detailed investigations into this study's results by conducting

further analyses using panel data that take individual characteristics into account.

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