

Effects of Maternal Employment on Adolescent Behavior and Academic Outcomes:
Evidence from Japanese Micro Data

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Abstract

This paper examines the short-term and long-term effects of maternal employment on adolescent children's outcomes, namely, on behavior and grades at school and on total years of education. Because a mother's decision to work depends heavily on her husband's socioeconomic characteristics in Japan, IV methods were employed to deal with this self-selection problem. The results show that maternal full-time employment itself does not hinder adolescents' human capital development. Rather, maternal full-time work prevents sons from smoking at school, although the path of this phenomenon should be carefully examined with more detailed data. Effects of maternal employment are not observed for sons' or daughters' educational attainment after controlling for family and school characteristics.

JEL classification codes: J13; J22; J24; I12

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1. Introduction

The labor force participation rate of married women in Japan has traditionally been considerably lower than in other developed countries: 48.8% in 2008 (Labor Force Survey, Bureau of Statistics Ministry of Internal Affairs and Communications). One of the major reasons for this phenomenon is considered to be the demanding nature of the Japanese employment system, which was established during the years of rapid economic growth after World War II. It required long working hours, frequent transfers and business trips, and even holiday work in exchange for lifetime employment and generous family allowances. These practices forced married women to leave the office and allowed them to stay at home as full-time homemakers, even if they could offer excellent human capital, as long as their husbands brought enough money home.

As a sociologist with expertise in gender issues in Japan, Brinton (1993) perceived that one of women's crucial roles in the postwar Japanese economy has been to participate indirectly: that is, they have nurtured higher-priced male labor, the labor of their husbands and sons. She emphasized, "particularly important is their investment in the quality of children, especially sons." There is still a belief among the Japanese that at-home-mothers play an important role in their sons' human capital development.

Only recently have more married women wanted to stay in the labor force longer than before. This is because they have more skills and education, employment practices have been changing, and households require a second income. According to the Annual Health, Labour and Welfare Report (MHLW, 2002), 74.9% of wives whose spouses were employees were full-time homemakers in 1955, but since the 1990s, the number of double-income households has exceeded that of households with full-time homemakers.

Meanwhile, the gender division of labor at home has persisted, and most of the housework and childrearing is still borne by wives in Japan. When a wife works outside the home, she has to distribute her time between her work and the housework. This may lead her to spend less time supervising her children than would a full-time homemaker, since everyone has only 24 hours per day. Despite this concern, wives will soon be required to participate more in the labor force for two reasons: the labor force is shrinking due to the falling birthrate and aging population, and lifetime employment for men is no longer the norm in Japanese employment practices.

However, it has not been well examined how mothers' employment influences their children's human capital development, i.e., their behavior and academic achievement. Because mothers' employment could be strongly linked to their husbands' socioeconomic status in Japan¹, looking at simple statistics based on mothers' employment status might be misleading.

The aim of this paper is to examine the effects of maternal employment on children's human capital development with a special emphasis on gender difference. In doing so, this research controls for household economic situation and educational background of parents. Furthermore, this research employs a type of instrumental variable (IV) method in order to address the possible endogeneity of maternal employment to children's outcomes. Specifically, a recursive bivariate probit model and a treatment effect model are used in addition to a univariate probit model with the number of childcare facilities in the area as an identifying excluded restriction. The analysis is conducted using data from the Japanese Life Course Panel Survey (JLPS)

¹ A negative relationship between husbands' income and wives' market labor has historically been observed in Japan and it is known as the "Douglas-Arisawa Law." Kohara (2008) examined this relationship with relatively recent data and found that while it was weak but evident in 1993, it was not statistically significant in 1996.

carried out by the University of Tokyo Institute of Social Science.

This research contributes to the current literature in three ways. First, it scrutinizes how maternal employment affects children's outcome using IV methods to deal with the endogeneity of maternal employment. Second, this study examines the short-term and direct effects of maternal employment using unique questionnaires regarding adolescents' behavior at school. It enables us to detect how at-home mothers and working mothers are different in supervising their children. Lastly, it compares the effects of maternal employment on short-term behavior and on long-term educational achievement.

The remainder of this paper is organized as follows: In the next section, I briefly explain the related literature. In Section 3, the theoretical framework is explained, and the data and descriptive statistics are described in Section 4. In Section 5, empirical strategies are shown. The results are presented in Section 6, and Section 7 discusses the study.

2. Related literature

There is a considerable amount of literature examining the influence of maternal employment on children's development. In particular, the influence of maternal employment on children's cognitive development when children are in infancy has drawn researchers' attention in the context of welfare-to-work policies in the United States. These analyses generally indicate some adverse impact of first-year maternal employment and some positive effects or less consistent impact of second-year and later maternal employment on children's cognitive outcomes (Han et al., 2001; Brooks-Gunn et al., 2002; Waldfogel et al., 2002; Baum, 2003; Ruhm, 2004; Hill et al.,

2005; James-Burdumy, 2005).

In recent years, some researchers have focused on the effects of maternal employment when children are adolescents, since adolescents experience substantial changes in their physical, intellectual, and mental conditions. Some have hypothesized that mothers having jobs outside the home spend less time supervising their children, which incurs negative influence on the children. Others have hypothesized that maternal employment brings additional economic resources into the household, which may be spent on children's education, which has positive effects on the children. Another hypothesis is that working mothers can be role models for their children, especially daughters.

Empirical analyses were conducted in order to test each hypothesis. Much attention was paid to examining the impact of parental supervision time on children's behavior. The results show that children who stay home alone after school are more likely to skip school, use alcohol or marijuana, steal, or hurt someone based on a sample of children aged 10 to 14 years (Aizer, 2004). Lopoo (2004) estimated the effect of maternal employment on teenage daughters' likelihood of becoming pregnant and found a negative relationship, but also found that teenagers with working mothers who attended elite schools were more likely to become pregnant than teens who attended similar schools but had non-working mothers. Aizer (2004) used the family fixed-effect model to deal with endogeneity of maternal employment, while Lopoo (2004) included a rich set of variables to control for the characteristics related to both maternal employment and teenage childbearing, using the school fixed-effect model to control for area-specific variations.

Aughinbaugh and Gittleman (2004) examined the impact of maternal employment

during a child's first three years and during adolescence on the likelihood of children engaging in risky behaviors: smoking cigarettes, drinking alcohol, using marijuana and other drugs, engaging in sex, and committing crimes. Exploiting the mother's fixed-effect model, they found no strong evidence that maternal employment affects the likelihood of these risky behaviors. The relationship between maternal employment and academic achievement depends on the socioeconomic characteristics of the household to which an adolescent belongs. Using ANOVA, Bogenschneider and Steinberg (1994) found that upper-middle-class and middle-class boys reported lower grades at high school when their mothers were working. This may be interpreted as indicating that additional resources brought in to a household through the mother's work have positive effects through investment in children's education if the household is poor, but negative effects from a lack of children's supervision overwhelm such a positive effect if the household is rich to begin with, although this assumes that the maternal employment status is exogenous.

Lopoo (2007) examined the relationship between a mother's employment and the after-school activities of her adolescent children based on the second hypothesis. Using the individual fixed-effect model, he found a positive relationship between maternal employment and participation in lessons after school for the children of married women with at least a high school education, and found that maternal employment is also positively related to sports participation for the children of unmarried women. This suggests that maternal employment affects adolescent children's behavior through the additional economic resources that it brings into a household.

Since Japan does not have panel data that contain parental socioeconomic status and working hours along with their children's outcomes, research is very limited. Of the

research that has been done, two studies relate to the effects of an adolescent's maternal employment, specifically when the child is a junior-high-school student. Kawaguchi and Miyazaki (2009) found that men raised by full-time working mothers are less likely to support traditional gender roles. Tanaka (2008) tested the role model effect and found that full-time maternal employment has a negative effect only on sons' educational attainment. Both of these studies treat maternal employment as exogenous.

In the next section, I outline the hypotheses this study tests. As stated previously, a wife's decision to work is related to her household income, spouse's education, and regional characteristics, as well as her own educational attainment. Wives in households that have fewer economic resources and less interest in the children's education may tend to work. In such cases there is a bias caused by self-selection. Therefore, the analysis should address the endogeneity of maternal employment. In the analysis, I use a type of IV method to deal with this.

3. Theoretical framework

The theoretical framework of this analysis is straightforward. In the human capital model (Becker and Tomes, 1976), children's quality depends on parents' available time, economic resources, endowments received, and other factors. The more time parents spend with their children, and the more economic resources they invest in their children, the more likely it is that their children will succeed.

The principle hypothesis that this research examines is whether Japanese at-home mothers play a crucial role in their son's human capital development. If this hypothesis is true, when mothers engage in full-time work, their sons' human capital is decreased.

It is ideal to include a mother's actual working hours and her earnings in the equation to examine how maternal employment affects children's outcomes, but unfortunately the data this research uses does not contain mothers' working hours or earnings. It has information on whether mothers work full time or part time. Since working hours vary for part-time workers, this study compares how full-time working mothers and at-home mothers are different, assuming full-time mothers work about 35 or more hours a week. Therefore, we should bear in mind that the results obtained from the analyses are the net effect of maternal full-time work.

A tricky part in estimating the causal effect of maternal employment is that the selection to work full time while raising children may be correlated to the outcome variable, which is children's human capital in this research. If mothers who work full time differ from those who stay at home in unobservable characteristics that affect adolescent human capital, the results obtained from conventional OLS regression could be biased. For example, if women who want to quit their jobs when they marry tend to choose husbands who have more marketable human capital, which would be inherited by their children, the positive effects of maternal full-time employment may be understated. On the other hand, if women who keep full-time jobs even after giving birth might be more diligent, such a trait would be inherited by their children, and the effects of maternal full-time employment may be overstated.

Potential methods to deal with this endogeneity problem using observational data are, first, matching methods such as propensity score matching (PSM), and, second, panel methods and IV methods. As Rosenbaum and Rubin (1983) proposed, if the propensity score incorporates all the information about selection, PSM can achieve optimal efficiency and consistency. However, if the selection involves factors that are

not observable, the estimator will be both biased and inefficient. Therefore, this study does not use this method.

Panel methods are a good way to control for unobservable individual heterogeneity, as when Aughinbaugh and Gittleman (2004) used mothers' or grandparents' fixed effect. Since the data for this research do not include information on siblings' human capital, I use IV methods to identify the effect of maternal employment. Detailed identification strategies are described in Section 5.

4. Data

The Japanese Life Course Panel Survey (JLPS) carried out by the University of Tokyo Institute of Social Science was used for this analysis. JLPS consists of two surveys: the youth survey and the middle-aged survey. The youth survey sampled respondents from the population of men and women aged 20 to 34 years residing in Japan, and the middle-aged survey men and women aged 35 to 40 residing in Japan, using the electoral registry and resident registry. The first wave of JLPS was conducted from January to April 2007. For the youth survey, 3,367 responses were obtained (response rate: 34.5%), and 1,433 responses (response rate: 40.4%) were obtained for the middle-aged survey. From January to March 2008, respondents were contacted again for a follow-up survey. There were 2,719 responses (response rate: 80%) for the youth survey and 1,246 responses (response rate: 87%) for the middle-aged survey.

The survey was designed to investigate how lifestyle and way of thinking among the Japanese working population change when the labor market structure changes and the society is rapidly aging. It included a wide range of questions regarding respondents' work, life, attitudes, and socioeconomic status. Additionally, JLPS 2007

included some retrospective questions asking about respondents' parents' employment status and occupation when the respondents were in junior high school, as well as their household's economic status. Furthermore, JLPS 2008 asked respondents about their attitudes at junior high school and academic performance at school. I use the responses to these retrospective questions to create outcome variables in this research.

Consequently, I employed two waves (2007 and 2008) of the youth and middle-aged surveys, although the analyses are cross-sectional. Most of the information I used comes from wave 1, and the information regarding the behavior when a respondent was in junior high school comes from wave 2.

Two types of outcome variables are examined in this study: short-term outcome variables and long-term outcome variables. The short-term variables include behavior at junior high school, such as whether the respondent skipped a class, smoked at school, or had bad grades at school. The long-term outcome variable investigated is total years of education. Details of each variable are explained below.

a. Behavior at junior high school

I have assumed that a mother's involvement in paid work decreases the time she spends on the supervision of her children and analyzed the effects of this on the children's behavior at school. Variables to be explained are whether the children skipped a class and whether they smoked at school. Each variable is coded as 1 when a respondent answers "yes," and 0 otherwise. Since the ratio of girls who smoked at school is very low and not sufficient for an econometric analysis, only the analysis on skipping a class is conducted for the female sample.

b. Grades at junior high school

Each respondent was asked, “How good were your grades at school compared to the average when you were in the third year of junior high school?” The possible answers were above average, somewhat above average, average, somewhat below average, and below average. This variable takes 1 if a respondent chose below or somewhat below average and 0 otherwise.

c. Years of education

I analyze the influence of adolescents’ mothers’ employment on their final educational attainment, namely, the total years of education. It is very difficult to distinguish a causal relationship between past mother’s employment and educational attainment in later life. Therefore, the results should be interpreted with caution. It might be an indirect causation rather than a direct one.

The key independent variable in this study is *fulwork*. It indicates whether the mother worked full time when the respondent was a junior high-school student. A comparison group consists of stay-at-home mothers.

The sample analyzed in this research is limited to persons who had already completed their education. Specifically, I dropped those who were still going to school or who were younger than 23 years old from the analysis. In order to control for the effect of paternal commitment to childcare, samples are also limited to those who lived with both parents when they were in junior high school.

Table 1 summarizes the descriptive statistics of the sample by gender and mother’s

employment status, indicated as full-time work, part-time work, or stay at home. Respondents whose mothers were self-employed or family employees were dropped from the sample because these kinds of jobs are too diverse in terms of time allocation and working style. When we look at the outcome variables by mother's employment status, there are clear differences across the groups. Comparing children whose mothers were working full time when they were adolescents with those raised by stay-at-home mothers, for example, mothers' paid work shows some adverse effects on children's behavior. Of sons whose mothers worked full time, 27.4% skipped school, whereas 20.3% of sons whose mothers stayed at home did so. Although the absolute ratio is small, 14.9% of sons raised by full-time working mothers smoked a cigarette at school, whereas only 10.6% of sons raised by stay-at-home mothers did so. Similar tendencies are observed regarding academic achievement. About 27% of sons raised by full-time working mothers said that their grades when they were in the third year of junior high school were "below average" or "somewhat below average," compared to 25.6% of those raised by stay-at-home mothers. That ratio is even higher among sons whose mothers worked part time. Furthermore, sons raised by stay-at-home mothers completed 14.7 years of education on average, while those raised by full-time working mothers completed 14.2 years. Similar tendencies are observed among female respondents. Although more daughters raised by full-time working mother reported that their grades at junior high school were bad, daughters raised by part-time mothers received the fewest years of education.

Looking at the socioeconomic characteristics of respondents by mother's employment status, it is clear that the economic situation of a household correlates to maternal employment status. The level of living standard among sons whose mothers

stayed at home was 3.25, but 3.07 and 2.87 among those whose mothers had full-time jobs and part-time jobs, respectively. The distribution of fathers' occupational categories shows a different pattern across the groups. Husbands of stay-at-home mothers tended to be engaged in professional, administrative, and clerical jobs, whereas more husbands of full-time workers were engaged in manufacturing jobs. However, the percentage of mothers with college degrees was highest in the group of full-time working mothers.

Mothers' employment status by their husbands' education separately calculated by gender is shown in Table 2. Fathers are divided into two groups based on whether they have college degrees. In households in which the fathers had college degrees, the mothers tended to stay at home, while in households in which the fathers did not have degrees, the mothers tended to seek jobs outside the home. This tendency is stronger among mothers of sons than mothers of daughters.

Although the descriptive statistics includes part-time working mothers, only full-time working mothers and at-home mothers are included in the econometric analysis. Part-time working mothers are excluded because the data do not have information about the number of working hours, although part-time workers are more diverse in terms of hours of work and or commitment to housework².

5. Empirical models

5.1. Univariate regression

This study estimates the effects of maternal full-time employment on children's

² The results from univariate regression using samples consisting of part-time working mothers and at-home mothers are presented in Appendix Table 1 and Appendix Table 2.

outcome with stay-at-home mothers as a reference group.

The linear specification of the model is written as follows:

$$C_i = \alpha + \beta M_i + \gamma \mathbf{X}_i + \varepsilon_i \quad (1)$$

where C_i represents the outcome measures of child i , M_i indicates the state of maternal employment (working full time in this study), and \mathbf{X}_i is a vector of control variables, including family and school characteristics.

In the probit model, C_i is replaced by C_i^* , where C_i^* is a latent variable that indicates the propensity of each outcome, and

$$C_i = \begin{cases} 1 & \text{if } C_i^* > 0 \\ 0 & \text{if } C_i^* \leq 0 \end{cases} \quad (2)$$

The first three behavioral outcome variables, which are skipping school, smoking cigarettes, and getting bad grades, are analyzed with the probit model. Then, the years of education are analyzed with OLS.

The explanatory variables included in \mathbf{X}_i are the basic sociodemographic characteristics of a respondent and his or her characteristics when in junior high school. The former variables are current age, gender, parents' education, and number of siblings. The latter variables are living standard, father's job category, and school characteristics. The dummy variables that describe the school characteristics are *probschool15* and *tardy15*. *probschool15* takes 1 if a junior high school had many problem students. *tardy15* takes 1 if students of the school tended to be tardy for class. These variables control for the peer effect of problematic behavior at school.

5.2. IV methods

If there is unobservable heterogeneity that is not included in \mathbf{X}_i but is correlated

with both C_i and M_i , the estimate of $\hat{\beta}$ will be biased. In this case, a type of IV method would be appropriate, as stated in Section 3. When a binary outcome variable is an interest, the sequential bivariate probit model is used. The first equation below [equation (3)] estimates the determinants of maternal employment, and the second equation [equation (4)] estimates the effects of maternal employment.

$$M_i^* = \alpha_1 + \gamma_1 \mathbf{X}_{1i} + \lambda_1 \mathbf{Z}_{1i} + \varepsilon_{1i}$$

$$M_i = \begin{cases} 1 & \text{if } M_i^* > 0 \\ 0 & \text{if } M_i^* \leq 0 \end{cases} \quad (3)$$

$$C_i^* = \alpha_2 + \beta_{21} M_i + \gamma_2 \mathbf{X}_{2i} + \varepsilon_{2i}$$

$$C_i = \begin{cases} 1 & \text{if } C_i^* > 0 \\ 0 & \text{if } C_i^* \leq 0 \end{cases} \quad (4)$$

where C_i represents the outcome measures of child i , M_i indicates the state of maternal employment, and \mathbf{X}_i is a vector of control variables, including family and school characteristics as previously defined. We assume

$$\begin{pmatrix} \varepsilon_{2i} \\ \varepsilon_{1i} \end{pmatrix} \sim N \left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix} \right)$$

The model above is estimated by full information maximum likelihood (FIML).

When a dependent variable is a continuous variable, a treatment effect model is employed.

$$C_i = \alpha_2 + \beta_{21} M_i + \gamma_2 \mathbf{X}_{2i} + \varepsilon_{2i} \quad (5)$$

M_i is specified as:

$$M_i^* = \alpha_1 + \gamma_1 \mathbf{X}_{1i} + \lambda_1 \mathbf{Z}_{1i} + \varepsilon_{1i}$$

The model is quite similar to the recursive probit model, but the two-step estimation

proposed by Maddala (1983) is used for this estimation instead of maximum likelihood estimation because of the relatively small sample size. It estimates selection of full-time employment choice by a probit estimation in the first stage and then estimates equation (5) by including the predicted value of selectivity correction as an additional regressor.

Instrument variable

In search for the IVs, Z_{1i} , two conditions should be satisfied: first, the IV should be correlated with the mother's choice of full-time work; second, it should not be correlated with outcome variables. Potential candidates for IV are variables representing the labor market conditions, relative value of female wage to male wage, and childcare conditions when a respondent was 15 years old. After deliberation, this study uses *daycare* as exclusion restriction Z_{1i} , which is the number of day nurseries per 100,000 population of 0–5 years old in the residential region when the respondent was 15 years old.³

6. Results

6.1. Results from the univariate regression

Table 3 shows the effects of mothers' full-time work on sons' behavioral and academic outcomes from univariate probit and OLS analyses. The effects of *fulwork* are consistently significant either on "skipping school" or "smoking at school" in all three models. If mothers work full time, their sons are more likely to skip a class or to

³ Other IV candidates were examined for eligibility, including the jobs-to-applicants ratio, labor force participation rate of women, ratio of nuclear families, number of child-welfare institutions, ratio of women's average wage to men's wage, which are all regional-level variables.

smoke at school. When nothing else is controlled for, maternal full-time work has a significant negative effect on sons' total years of education, which is consistent with Tanaka's (2008) result, but after parental education and household economic situation are controlled for, that effect disappears.

The effects of mothers' full-time work on daughters' behavioral and academic outcomes are presented in Table 4. Maternal full-time employment has a statistically significant effect on daughters' skipping a class at the 10 percent level in all three models. However, maternal employment does not affect daughters' total years of education.

The results from univariate regressions show maternal full-time work has significant adverse effects on children's behavior, but no clear gender asymmetry is observed.

Among other explanatory variables, it is observed that parental education has strong influence on both sons' and daughters' behavior. Respondents who said they did not know their fathers' educational attainment tended to skip a class when they were junior high-school students. School characteristics are other factors that influence the students' behaviors for sons or daughters. A mother's educational attainment of greater than high school significantly decreases the probability of her sons' smoking at school. Father's job category and having elder siblings also have significant effects on sons' smoking behavior. This is because adolescents are prone to be affected by surrounding senior people's behavior. Parents' education influences their children's performance at school, as many previous studies have shown. It is interesting that mothers' low education has negative effects on sons' performance at school and fathers' low education has negative effects on daughters' performance.

The standard of living at adolescence has significant influence on total years of

education among sons, as we expected. When the household was poor, children had less opportunity to get an advanced education.

6.2. Results from the IV estimation

Table 5 presents the results from the IV estimation. In all equations estimating determinants of maternal full-time employment, the coefficients of *daycare* are statistically significant at the one percent level. Other factors affecting maternal full-time employment are the father's education and the mother's own education. In consideration of the endogeneity of maternal employment, the only coefficient in the equation estimating *smoke15* is statistically significant, and its sign is negative. It indicates sons whose mothers worked full time were less likely to smoke at school, which is contrary to the results from a simple cross-tabulation. *fulwork* does not have significant effects on sons' other outcomes.

The results from the estimation of the female sample are presented in Table 6. In all equations estimating *fulwork*, the coefficients of *daycare* are statistically significant. Unlike the results of the male sample, none of the coefficients of *fulwork* are statistically significant. Therefore, maternal full-time work itself does not have any direct effects on daughters' behavioral or academic outcomes.

7. Discussion and Concluding Remarks

In this paper, I analyzed the short-term and long-term effects of maternal employment on adolescent children's outcomes, namely, on behavior and grades at school and on total years of education. Because a mother's decision to work depends heavily on her husband's socioeconomic characteristics in Japan, IV methods were

employed to deal with this self-selection problem.

The results from univariate probit and OLS analyses with a rich set of covariates show significant adverse effects of maternal full-time employment on both sons' and daughters' behavior at school, which is considered to be a short-term direct effect. It suggests that at-home mothers play an important role in their children's behavior, that is, there is not a gender asymmetry. However, those adverse effects are not observed in the results from estimation using IV methods. Rather, IV methods show that sons whose mothers worked full time were less likely to smoke at school. One possible interpretation of the result that maternal full-time employment has a good impact on sons' behavior is that mothers working full time might have better management skills and therefore be able to supervise their children more effectively. Although a separate estimation using mothers' education was not conducted due to the restriction of the sample size, mothers working full time with higher education might have more of those skills. To examine such a possibility could be a topic of further research.

Another possible interpretation might be related to after-school activities, as Lopoo (2007) suggested. Students at junior high school and high school are involved in various school club activities in Japan, which range from sports such as baseball and soccer to cultural activities such as brass band and calligraphy. Schools encourage their students to join any of these clubs, and many students spend their after-school hours at these activities. If students whose mothers are working full time are more likely to join school club activities, they might dedicate themselves to these activities so that they do not engage in smoking at school. Since the school characteristics have strong impact on adolescent behavior, the role of after-school activities should be examined.

To conclude, maternal full-time employment seems to have adverse effects on both

sons' and daughters' behavior at school as long as maternal employment status is assumed to be exogenous. However, after controlling for unobserved individual heterogeneity, it is found that maternal full-time employment itself does not hinder adolescents' human capital development. Rather, maternal full-time work prevents sons from smoking at school, although the path of this phenomenon should be carefully examined with more detailed data. Effects of maternal employment are not observed for sons' or daughters' educational attainment after controlling for family and school characteristics.

Factors affecting adolescent behavior are parents' educational attainment; father's occupation, interpreted as father's lifestyle; and school characteristics, whereas the factors influencing educational attainment are parents' educational attainment and the economic situation of the household. Therefore, if maternal employment improves the household economic situation, it consequently improves the children's human capital development. On the basis of real data, the belief that Japanese at-home mothers play crucial roles in their sons' human capital development in Japan does not seem true as far as maternal employment at adolescence is concerned.

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Table 1: Descriptive statistics of the sample

		Sons								Daughters							
		All		Full-time work		Part-time work		Stay-at-home		All		Full-time work		Part-time work		Stay-at-home	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
<Outcome variables>																	
skipping school	wag15	0.227	0.419	0.274	0.447	0.223	0.417	0.203	0.403	0.146	0.353	0.167	0.374	0.146	0.354	0.129	0.336
smoking at school	smoke15	0.127	0.333	0.149	0.357	0.132	0.339	0.106	0.308	0.024	0.153	0.030	0.170	0.020	0.139	0.025	0.156
bad grade at school	badscore15	0.274	0.446	0.270	0.445	0.290	0.454	0.256	0.437	0.228	0.420	0.242	0.429	0.238	0.426	0.207	0.405
years of education	yearedu	14.383	2.029	14.177	2.001	14.225	2.042	14.706	1.995	14.045	1.562	14.108	1.533	13.908	1.554	14.171	1.583
<Explanatory variables>																	
respondent current age	age	32.376	4.427	32.181	4.619	32.374	4.287	32.500	4.480	32.550	4.760	32.022	4.815	32.517	4.803	32.981	4.633
father's educ: junior high	faedcat1	0.194	0.396	0.209	0.408	0.218	0.414	0.156	0.363	0.219	0.414	0.223	0.417	0.242	0.429	0.187	0.391
father's educ: high schl	faedcat2	0.414	0.493	0.428	0.496	0.463	0.499	0.344	0.476	0.378	0.485	0.390	0.489	0.395	0.489	0.347	0.477
father's educ: training schl	faedcat3	0.027	0.161	0.028	0.165	0.019	0.137	0.035	0.185	0.032	0.176	0.056	0.230	0.017	0.131	0.033	0.179
father's educ: junior college	faedcat4	0.021	0.142	0.014	0.118	0.022	0.145	0.024	0.152	0.019	0.138	0.019	0.135	0.022	0.146	0.017	0.128
father's educ: college and more	faedcat5	0.239	0.426	0.209	0.408	0.175	0.380	0.335	0.473	0.262	0.440	0.201	0.401	0.236	0.425	0.342	0.475
father's educ: don't know	faedcat6	0.106	0.308	0.112	0.316	0.103	0.304	0.106	0.308	0.089	0.285	0.112	0.315	0.087	0.283	0.074	0.263
mother's educ: junior high	maedcat1	0.153	0.360	0.167	0.374	0.173	0.378	0.121	0.326	0.214	0.410	0.190	0.393	0.240	0.428	0.198	0.399
mother's educ: high schl	maedcat2	0.514	0.500	0.451	0.499	0.547	0.498	0.515	0.501	0.470	0.499	0.420	0.494	0.496	0.501	0.474	0.500
mother's educ: training schl	maedcat3	0.064	0.244	0.098	0.298	0.048	0.214	0.062	0.241	0.074	0.262	0.097	0.296	0.068	0.251	0.066	0.249
mother's educ: junior college	maedcat4	0.074	0.262	0.070	0.255	0.062	0.242	0.091	0.288	0.096	0.295	0.112	0.315	0.076	0.266	0.110	0.314
mother's educ: college and more	maedcat5	0.070	0.255	0.107	0.310	0.034	0.180	0.091	0.288	0.071	0.256	0.089	0.286	0.044	0.205	0.091	0.288
mother's educ: don't know	maedcat6	0.124	0.330	0.107	0.310	0.137	0.344	0.121	0.326	0.075	0.264	0.093	0.291	0.076	0.266	0.061	0.239
# of elder siblings	eldersib	0.633	0.765	0.628	0.731	0.578	0.743	0.703	0.807	0.701	0.810	0.632	0.734	0.718	0.778	0.730	0.897
# of younger siblings	youngsib	0.722	0.759	0.698	0.715	0.758	0.800	0.694	0.733	0.738	0.794	0.755	0.787	0.710	0.761	0.760	0.841
state of living	inc15	3.047	0.730	3.070	0.742	2.873	0.666	3.247	0.747	3.116	0.759	3.182	0.806	2.952	0.653	3.273	0.807
father's job: professional	fajobccat1	0.193	0.395	0.228	0.420	0.137	0.344	0.241	0.428	0.182	0.386	0.186	0.390	0.159	0.366	0.207	0.405
father's job: administrative	fajobccat2	0.178	0.383	0.149	0.357	0.153	0.361	0.226	0.419	0.181	0.385	0.126	0.333	0.168	0.374	0.237	0.426
father's job: clerical	fajobccat3	0.099	0.299	0.079	0.270	0.096	0.295	0.115	0.319	0.102	0.303	0.097	0.296	0.100	0.301	0.107	0.310
father's job: sales	fajobccat4	0.110	0.313	0.084	0.278	0.132	0.339	0.100	0.300	0.088	0.284	0.100	0.301	0.081	0.273	0.088	0.284
father's job: service	fajobccat5	0.036	0.186	0.033	0.178	0.053	0.224	0.018	0.132	0.041	0.199	0.059	0.237	0.046	0.209	0.022	0.147
father's job: manufacturing	fajobccat6	0.258	0.438	0.293	0.456	0.295	0.457	0.191	0.394	0.260	0.439	0.279	0.449	0.303	0.460	0.190	0.393
father's job: transportation	fajobccat7	0.094	0.291	0.112	0.316	0.096	0.295	0.079	0.271	0.093	0.290	0.112	0.315	0.079	0.269	0.096	0.296
problem school	probschool15	0.226	0.419	0.247	0.432	0.235	0.425	0.203	0.403	0.260	0.439	0.305	0.461	0.262	0.440	0.223	0.417
tardy school	tardy15	0.091	0.287	0.084	0.278	0.091	0.288	0.094	0.292	0.072	0.259	0.071	0.257	0.079	0.269	0.066	0.249
# of day nurseries/100,000																	
population of 0-5 years old	daycare	266.297	111.154	305.389	124.453	262.438	107.724	246.310	99.916	279.803	119.593	321.007	135.286	274.783	110.987	255.602	109.747
# of obs		972		215		417		340		1090		269		458		363	

Table 2: Mother's employment status by father's education

Mother's employment status	Sons				Daughters			
	Father's educ: No college		Father's educ: College or more		Father's educ: No college		Father's educ: College or more	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Full-time work	200	22.55	67	20.55	260	26.83	84	21.54
Part-time work	434	48.93	102	31.29	423	43.65	142	36.41
Stay-at-home	253	28.52	157	48.16	286	29.51	164	42.05
Total	887	100	326	100	969	100	390	100

Table 3: Effects of maternal fulltime work on sons' outcomes

	Variables	Skipping school Probit model			Smoking at school Probit model			Bad grade at school Probit model			Years of education OLS		
		(1) dF/dx	(2) dF/dx	(3) dF/dx	(4) dF/dx	(5) dF/dx	(6) dF/dx	(7) dF/dx	(8) dF/dx	(9) dF/dx	(10) Coeff.	(11) Coeff.	(12) Coeff.
mother's full-time work	fulwork	0.0804** (0.0362)	0.0727** (0.0362)	0.0768** (0.0366)	0.0519* (0.0289)	0.0617** (0.0269)	0.0606** (0.0254)	0.0209 (0.0379)	-0.00212 (0.0380)	-0.00998 (0.0382)	-0.494*** (0.167)	-0.240 (0.153)	-0.247 (0.152)
father's educ: junior high	faedcat1		0.0815 (0.0612)	0.111* (0.0671)		0.00215 (0.0382)	0.0115 (0.0392)		0.0182 (0.0614)	0.0423 (0.0641)		-0.382 (0.268)	-0.436 (0.266)
father's educ: training schl	faedcat3		0.00911 (0.109)	0.0133 (0.104)		-0.0545 (0.0466)	-0.0382 (0.0466)		-0.156** (0.0732)	-0.152** (0.0708)		0.351 (0.463)	0.297 (0.458)
father's educ: junior college	faedcat4		0.300* (0.153)	0.321** (0.151)		0.158 (0.151)	0.134 (0.117)		0.0268 (0.139)	0.0207 (0.142)		0.951 (0.595)	0.945* (0.563)
father's educ: college and more	faedcat5		-0.0381 (0.0510)	-0.0397 (0.0514)		0.0655 (0.0430)	0.0698 (0.0436)		-0.0102 (0.0552)	-0.00545 (0.0551)		0.680*** (0.192)	0.686*** (0.193)
father's educ: don't know	faedcat6		0.425** (0.193)	0.386* (0.206)		0.0665 (0.134)	0.0385 (0.120)		0.258* (0.154)	0.198 (0.146)		-0.792* (0.424)	-0.713* (0.411)
mother's educ: junior high	maedcat1		-0.0359 (0.0524)	-0.0393 (0.0541)		-0.0368 (0.0314)	-0.0317 (0.0301)		0.117* (0.0704)	0.150** (0.0737)		-0.811*** (0.267)	-0.816*** (0.266)
mother's educ: training schl	maedcat3		-0.0603 (0.0602)	-0.0674 (0.0582)		-0.0667*** (0.0243)	-0.0646*** (0.0208)		0.103 (0.0814)	0.0874 (0.0802)		0.439 (0.276)	0.454* (0.274)
mother's educ: junior college	maedcat4		-0.0654 (0.0604)	-0.0362 (0.0669)		-0.101*** (0.0166)	-0.0862*** (0.0163)		0.0907 (0.0837)	0.0952 (0.0838)		0.0472 (0.285)	0.00925 (0.288)
mother's educ: college and more	maedcat5		-0.103* (0.0565)	-0.0832 (0.0602)		-0.0839*** (0.0227)	-0.0724*** (0.0212)		-0.0865 (0.0676)	-0.0849 (0.0681)		0.116 (0.276)	0.0720 (0.278)
mother's educ: don't know	maedcat6		-0.230*** (0.0517)	-0.206*** (0.0587)		-0.0415 (0.0693)	-0.0145 (0.0820)		-0.0503 (0.114)	0.00806 (0.118)		0.0196 (0.397)	-0.0812 (0.386)
# of elder siblings	eldersib		0.0372 (0.0251)	0.0342 (0.0244)		0.0339** (0.0170)	0.0291* (0.0150)		0.0291 (0.0270)	0.0248 (0.0272)		-0.225* (0.115)	-0.202* (0.114)
# of younger siblings	youngsib		-0.0190 (0.0274)	-0.0183 (0.0274)		0.00649 (0.0195)	0.00855 (0.0181)		-0.0428 (0.0293)	-0.0437 (0.0302)		-0.00548 (0.112)	0.0181 (0.112)
state of living	inc15		0.0170 (0.0246)	0.0144 (0.0240)		0.0512*** (0.0173)	0.0475*** (0.0155)		-0.00848 (0.0269)	-0.0162 (0.0264)		0.204** (0.100)	0.208** (0.101)
father's job: admininstrative	fajobccat2		0.0160 (0.0553)	0.0139 (0.0554)		-0.0359 (0.0340)	-0.0402 (0.0301)		-0.0215 (0.0570)	-0.0117 (0.0582)		-0.396* (0.203)	-0.391* (0.202)
father's job: clerical	fajobccat3		-0.0284 (0.0627)	0.00189 (0.0664)		0.0345 (0.0578)	0.0561 (0.0635)		0.0833 (0.0772)	0.105 (0.0785)		-0.0189 (0.271)	-0.0677 (0.272)
father's job: sales	fajobccat4		0.0184 (0.0695)	0.0161 (0.0712)		0.154** (0.0726)	0.140** (0.0711)		0.0361 (0.0759)	0.0196 (0.0735)		-0.514* (0.278)	-0.479* (0.273)
father's job: service	fajobccat5		0.0692 (0.128)	0.106 (0.136)		0.277* (0.164)	0.319* (0.173)		0.0916 (0.140)	0.0945 (0.135)		0.198 (0.640)	0.172 (0.640)
father's job: manufacturing	fajobccat6		0.0620 (0.0552)	0.0465 (0.0544)		0.0889* (0.0483)	0.0692 (0.0450)		0.161** (0.0630)	0.142** (0.0633)		-1.120*** (0.218)	-1.092*** (0.216)
father's job: transportation	fajobccat7		0.0934 (0.0783)	0.0564 (0.0762)		0.217** (0.0850)	0.184** (0.0856)		-0.0454 (0.0705)	-0.0734 (0.0680)		-0.580* (0.330)	-0.514 (0.338)
respondent current age	age			-0.00183 (0.00354)			-0.00172 (0.00228)			-0.0143*** (0.00396)			0.0147 (0.0155)
problem school	probschool15			0.141*** (0.0487)			0.0657** (0.0320)			0.0892* (0.0489)			0.0586 (0.207)
tardy school	tardy15			0.353*** (0.0773)			0.240*** (0.0679)			0.136* (0.0719)			-0.683*** (0.263)
	Constant										14.68*** (0.106)	14.51*** (0.411)	14.06*** (0.677)
	Observations	587	587	587	587	587	587	587	587	587	591	591	591
	Log-likelihood	-312.792	-294.857	-271.545	-218.732	-193.218	-175.388	-344.690	-319.499	-308.917			
	R-squared										0.015	0.246	0.256

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Effects of maternal fulltime work on daughters' outcomes

	Variables	Skipping school Probit model			Bad grade at school Probit model			Years of education OLS		
		(1) dF/dx	(2) dF/dx	(3) dF/dx	(4) dF/dx	(5) dF/dx	(6) dF/dx	(7) Coeff.	(8) Coeff.	(9) Coeff.
mother's full-time work	fulwork	0.0503* (0.0278)	0.0492* (0.0277)	0.0451* (0.0271)	0.0314 (0.0325)	0.00789 (0.0332)	0.00338 (0.0334)	-0.170 (0.121)	-0.0614 (0.112)	-0.0793 (0.114)
father's educ: junior high	faedcat1		0.128** (0.0551)	0.116** (0.0559)		0.0968* (0.0540)	0.0959* (0.0540)		-0.456*** (0.161)	-0.440*** (0.161)
father's educ: training schl	faedcat3		0.149* (0.0905)	0.102 (0.0830)		-0.0159 (0.0777)	-0.0387 (0.0722)		-0.0691 (0.285)	-0.0880 (0.292)
father's educ: junior college	faedcat4								0.609** (0.287)	0.600** (0.285)
father's educ: college and more	faedcat5		0.0368 (0.0450)	0.0380 (0.0446)		-0.0456 (0.0480)	-0.0523 (0.0469)		0.406** (0.168)	0.389** (0.168)
father's educ: don't know	faedcat6		0.274** (0.108)	0.250** (0.106)		-0.0281 (0.0760)	-0.0377 (0.0704)		-0.731*** (0.278)	-0.710** (0.278)
mother's educ: junior high	maedcat1		-0.0307 (0.0352)	-0.0286 (0.0359)		-0.0104 (0.0448)	-0.00409 (0.0452)		-0.410** (0.160)	-0.399** (0.160)
mother's educ: training schl	maedcat3		-0.0707* (0.0366)	-0.0807** (0.0320)		-0.0582 (0.0555)	-0.0698 (0.0547)		0.671*** (0.197)	0.648*** (0.203)
mother's educ: junior college	maedcat4		-0.0754** (0.0367)	-0.0886*** (0.0310)		-0.0812 (0.0522)	-0.0918* (0.0506)		0.652*** (0.184)	0.632*** (0.189)
mother's educ: college and more	maedcat5		-0.0399 (0.0461)	-0.0448 (0.0438)		-0.0725 (0.0585)	-0.0777 (0.0565)		0.930*** (0.197)	0.911*** (0.201)
mother's educ: don't know	maedcat6		-0.0683 (0.0470)	-0.0643 (0.0458)		0.139 (0.107)	0.152 (0.105)		-0.0888 (0.280)	-0.0839 (0.284)
# of elder siblings	eldersib		-0.0141 (0.0159)	-0.0124 (0.0159)		0.0307 (0.0197)	0.0309 (0.0199)		-0.194** (0.0766)	-0.194** (0.0766)
# of younger siblings	youngsib		-0.0199 (0.0178)	-0.0272 (0.0173)		0.0180 (0.0206)	0.0151 (0.0204)		-0.158** (0.0762)	-0.156** (0.0762)
state of living	inc15		-0.0127 (0.0180)	-0.0115 (0.0178)		-0.0186 (0.0221)	-0.0196 (0.0220)		0.0389 (0.0675)	0.0315 (0.0685)
father's job: administrative	fajobccat2		0.0872* (0.0514)	0.0866* (0.0514)		-0.0961** (0.0447)	-0.0944** (0.0449)		0.227 (0.171)	0.240 (0.169)
father's job: clerical	fajobccat3		0.0493 (0.0617)	0.0403 (0.0593)		0.0668 (0.0659)	0.0652 (0.0658)		0.0948 (0.185)	0.105 (0.187)
father's job: sales	fajobccat4		0.124* (0.0688)	0.0941 (0.0646)		-0.00901 (0.0609)	-0.0176 (0.0599)		-0.163 (0.186)	-0.156 (0.188)
father's job: service	fajobccat5		0.115 (0.0914)	0.0898 (0.0861)		0.0806 (0.100)	0.0715 (0.101)		-0.121 (0.346)	-0.120 (0.348)
father's job: manufacturing	fajobccat6		-0.0278 (0.0388)	-0.0149 (0.0398)		0.0150 (0.0481)	0.0172 (0.0485)		-0.181 (0.168)	-0.195 (0.168)
father's job: transportation	fajobccat7		-0.0170 (0.0498)	-0.0203 (0.0503)		0.00650 (0.0616)	-3.27e-05 (0.0603)		-0.180 (0.215)	-0.178 (0.214)
respondent current age	age			-0.00272 (0.00256)			-0.00528 (0.00333)			-0.0134 (0.0118)
problem school	probschool15			0.0302 (0.0322)			0.0317 (0.0396)			0.119 (0.135)
tardy school	tardy15			0.313*** (0.0798)			0.114 (0.0778)			-0.260 (0.240)
	Constant								14.20*** (0.0805)	14.22*** (0.290)
	Observations	692	679	679	677	665	665	694	694	694
	Log-likelihood	-287.685	-270.771	-255.953	-357.584	-333.148	-329.513			
	R-squared							0.003	0.256	0.259

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Effects of maternal fulltime work on sons' outcomes: results from system of equations analysis

Variables	Skipping school			Smoking at school			Bad grade at school			Years of education			
	Recursive bivariate probit model			Recursive bivariate probit model			Recursive bivariate probit model			Treatment effect model			
	(1)	(1)	(1)	(2)	(2)	(2)	(3)	(3)	(3)	(4)	(4)	(4)	
	fulwork	wag15	athrho	fulwork	smoke15	athrho	fulwork	badscore15	athrho	yearedu second-step	fulwork first-step	hazard	
father's educ: junior high	faedcat1	-0.116 (0.191)	0.383* (0.207)		-0.0231 (0.197)	-0.110 (0.211)		-0.107 (0.190)	0.0504 (0.201)		-0.473* (0.255)	-0.126 (0.190)	
father's educ: training schl	faedcat3	-0.198 (0.346)	0.00632 (0.380)		-0.138 (0.353)	-0.553 (0.475)		-0.207 (0.349)	-0.608 (0.430)		0.263 (0.449)	-0.197 (0.346)	
father's educ: junior college	faedcat4	-0.514 (0.445)	0.846* (0.460)		-0.510 (0.475)	0.0912 (0.494)		-0.481 (0.432)	-0.0443 (0.447)		0.917 (0.561)	-0.518 (0.445)	
father's educ: college and more	faedcat5	-0.409** (0.173)	-0.224 (0.214)		-0.392** (0.174)	-0.108 (0.223)		-0.393** (0.170)	-0.222 (0.203)		0.673*** (0.240)	-0.394** (0.171)	
father's educ: don't know	faedcat6	0.218 (0.433)	1.336** (0.608)		0.139 (0.427)	0.306 (0.420)		0.210 (0.430)	0.647 (0.451)		-0.639 (0.555)	0.219 (0.434)	
mother's educ: junior high	maedcat1	0.167 (0.198)	-0.163 (0.220)		0.109 (0.202)	-0.0639 (0.218)		0.173 (0.197)	0.517*** (0.200)		-0.837*** (0.264)	0.155 (0.197)	
mother's educ: training schl	maedcat3	0.456** (0.230)	-0.207 (0.277)		0.467** (0.229)	-0.159 (0.309)		0.459** (0.232)	0.382 (0.252)		0.524* (0.318)	0.454** (0.230)	
mother's educ: junior college	maedcat4	0.0938 (0.231)	-0.0727 (0.268)		0.100 (0.228)	-0.592 (0.395)		0.0965 (0.228)	0.467** (0.236)		0.0132 (0.297)	0.0847 (0.230)	
mother's educ: college and more	maedcat5	0.557** (0.226)	-0.346 (0.315)		0.546** (0.225)	-0.236 (0.363)		0.552** (0.225)	-0.109 (0.314)		0.108 (0.318)	0.545** (0.225)	
mother's educ: don't know	maedcat6	-0.305 (0.420)	-1.352** (0.618)		-0.233 (0.423)	-0.266 (0.414)		-0.289 (0.415)	-0.175 (0.446)		-0.147 (0.536)	-0.306 (0.420)	
# of elder siblings	eldersib	-0.136 (0.0876)	0.103 (0.0933)		-0.128 (0.0856)	0.0441 (0.0934)		-0.130 (0.0874)	0.0148 (0.0915)		-0.201* (0.114)	-0.136 (0.0872)	
# of younger siblings	youngsib	-0.0492 (0.0921)	-0.0813 (0.107)		-0.0685 (0.0926)	0.00290 (0.0991)		-0.0533 (0.0927)	-0.242** (0.102)		0.0200 (0.120)	-0.0473 (0.0920)	
state of living	inc15	-0.165** (0.0822)	0.0273 (0.0964)		-0.164** (0.0818)	0.126 (0.113)		-0.145* (0.0813)	-0.0453 (0.0908)		0.173 (0.110)	-0.159* (0.0813)	
father's job: administrative	fajobccat2	-0.0675 (0.176)	0.0821 (0.203)		-0.0743 (0.177)	-0.341 (0.220)		-0.0364 (0.175)	-0.0224 (0.193)		-0.439* (0.226)	-0.0409 (0.175)	
father's job: clerical	fajobccat3	-0.258 (0.220)	0.0210 (0.267)		-0.273 (0.216)	0.0522 (0.260)		-0.239 (0.220)	0.287 (0.248)		-0.161 (0.289)	-0.243 (0.220)	
father's job: sales	fajobccat4	-0.107 (0.225)	-0.00887 (0.255)		-0.0636 (0.225)	0.309 (0.268)		-0.0749 (0.226)	-0.0334 (0.240)		-0.572** (0.288)	-0.0902 (0.225)	
father's job: service	fajobccat5	0.104 (0.393)	0.301 (0.418)		0.0771 (0.368)	0.884** (0.414)		0.112 (0.390)	0.367 (0.401)		0.151 (0.527)	0.132 (0.393)	
father's job: manufacturing	fajobccat6	0.209 (0.174)	0.134 (0.201)		0.217 (0.173)	0.318 (0.206)		0.238 (0.173)	0.510*** (0.179)		-1.124*** (0.237)	0.232 (0.173)	
father's job: transportation	fajobccat7	0.177 (0.221)	0.150 (0.242)		0.137 (0.217)	0.557** (0.254)		0.231 (0.222)	-0.133 (0.252)		-0.523* (0.297)	0.198 (0.221)	
respondent current age	age	0.00630 (0.0132)	-0.00513 (0.0149)		0.00424 (0.0130)	-0.00769 (0.0144)		0.00495 (0.0133)	-0.0345** (0.0137)		0.0177 (0.0170)	0.00642 (0.0132)	
problem school	probschool15	0.196 (0.145)	0.449*** (0.154)		0.249* (0.149)	0.324** (0.160)		0.202 (0.143)	0.275* (0.148)		0.0647 (0.192)	0.206 (0.143)	
tardy school	tardy15	-0.276 (0.217)	1.085*** (0.219)		-0.280 (0.219)	0.648*** (0.251)		-0.304 (0.214)	0.361 (0.222)		-0.783*** (0.275)	-0.295 (0.215)	
# of day nurseries/100,000 population of 0-5 years old	daycare	0.00287*** (0.000535)			0.00262*** (0.000592)			0.00290*** (0.000549)			0.00289*** (0.000535)		
mother's full-time work	fulwork		0.170 (0.545)			-1.194*** (0.297)			-0.655 (0.602)		-0.429 (0.651)		
	lambda											0.0983 (0.406)	
	Constant	-0.631 (0.588)	-1.031 (0.744)	0.0485 (0.338)	-0.516 (0.582)	-0.807 (0.895)	1.589* (0.836)	-0.682 (0.594)	0.649 (0.719)	0.419 (0.466)	14.18*** (0.849)	-0.677 (0.587)	
	Observations	558	558	558	558	558	558	559	559	559	562	562	562
	Log-likelihood		-593.249			-497.340			-621.943				

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Effects of maternal fulltime work on daughters' outcomes: results from system of equations analysis

Variables	Skipping school			Bad grade at school			Years of education		
	Recursive bivariate probit model			Recursive bivariate probit model			Treatment effect model		
	<i>fulwork</i>	<i>wag15</i>	<i>athrho</i>	<i>fulwork</i>	<i>badscore15</i>	<i>athrho</i>	<i>yearedu second-step</i>	<i>fulwork first-step</i>	<i>hazard</i>
father's educ: junior high	faedcat1	0.0162 (0.158)	0.495** (0.198)	0.0403 (0.161)	0.299* (0.170)		-0.441*** (0.171)	0.0258 (0.157)	
father's educ: training schl	faedcat3	0.110 (0.282)	0.224 (0.338)	0.117 (0.281)	-0.140 (0.313)		-0.0390 (0.292)	0.113 (0.281)	
father's educ: junior college	faedcat4	-0.107 (0.417)	-6.182 (42560)	-0.202 (0.436)	-6.442 (30830)		0.575 (0.432)	-0.0838 (0.416)	
father's educ: college and more	faedcat5	-0.598*** (0.172)	0.211 (0.242)	-0.573*** (0.167)	-0.337 (0.209)		0.382* (0.200)	-0.586*** (0.166)	
father's educ: don't know	faedcat6	-0.140 (0.285)	0.841*** (0.318)	-0.0846 (0.292)	-0.125 (0.313)		-0.754*** (0.291)	-0.125 (0.280)	
mother's educ: junior high	maedcat1	-0.0995 (0.157)	-0.177 (0.194)	-0.0758 (0.159)	-0.0296 (0.172)		-0.425** (0.168)	-0.0890 (0.156)	
mother's educ: training schl	maedcat3	0.260 (0.210)	-0.632** (0.293)	0.294 (0.212)	-0.256 (0.246)		0.701*** (0.227)	0.260 (0.209)	
mother's educ: junior college	maedcat4	0.463** (0.202)	-0.563** (0.263)	0.436** (0.198)	-0.214 (0.251)		0.542** (0.216)	0.433** (0.197)	
mother's educ: college and more	maedcat5	0.579** (0.228)	-0.243 (0.289)	0.572** (0.225)	-0.149 (0.286)		0.846*** (0.248)	0.567** (0.225)	
mother's educ: don't know	maedcat6	0.386 (0.297)	-0.413 (0.361)	0.355 (0.313)	0.613* (0.334)		-0.164 (0.317)	0.370 (0.293)	
# of elder siblings	eldersib	-0.130* (0.0677)	-0.0703 (0.0973)	-0.118* (0.0718)	0.107 (0.0807)		-0.204*** (0.0741)	-0.129* (0.0679)	
# of younger siblings	youngersib	-0.0347 (0.0697)	-0.125 (0.0952)	-0.0364 (0.0706)	0.0612 (0.0772)		-0.179** (0.0743)	-0.0381 (0.0698)	
state of living	inc15	-0.0502 (0.0703)	-0.0560 (0.0899)	-0.0436 (0.0706)	-0.0629 (0.0787)		0.00735 (0.0746)	-0.0490 (0.0703)	
father's job: administrative	fajobccat2	-0.269 (0.168)	0.418** (0.204)	-0.319* (0.170)	-0.361** (0.208)		0.223 (0.178)	-0.277* (0.168)	
father's job: clerical	fajobccat3	0.0295 (0.197)	0.102 (0.247)	0.0129 (0.198)	0.214 (0.215)		0.123 (0.210)	0.0161 (0.197)	
father's job: sales	fajobccat4	0.205 (0.201)	0.325 (0.256)	0.134 (0.202)	0.0161 (0.227)		-0.132 (0.217)	0.168 (0.200)	
father's job: service	fajobccat5	0.721** (0.303)	0.368 (0.411)	0.702** (0.304)	0.421 (0.315)		0.00408 (0.336)	0.711** (0.306)	
father's job: manufacturing	fajobccat6	0.196 (0.158)	-0.148 (0.211)	0.183 (0.159)	0.0572 (0.176)		-0.101 (0.173)	0.178 (0.157)	
father's job: transportation	fajobccat7	-0.0246 (0.198)	-0.111 (0.252)	-0.0310 (0.201)	-0.00366 (0.217)		-0.154 (0.211)	-0.0367 (0.196)	
respondent current age	age	-0.0153 (0.0123)	-0.0156 (0.0179)	-0.0143 (0.0124)	-0.0208 (0.0142)		-0.0295** (0.0136)	-0.0136 (0.0122)	
problem school	probschool15	0.261** (0.128)	0.144 (0.183)	0.292** (0.128)	0.0872 (0.151)		0.176 (0.145)	0.261** (0.127)	
tardy school	tardy15	-0.324 (0.224)	1.004*** (0.229)	-0.377* (0.228)	0.343 (0.240)		-0.248 (0.239)	-0.319 (0.224)	
# of day nurseries/100,000 population of 0-5 years old	daycare	0.00242*** (0.000462)		0.00240*** (0.000449)				0.00245*** (0.000442)	
mother's full-time work	<i>fulwork</i>		0.536 (0.804)		-0.142 (0.482)		-0.684 (0.510)		
	lambda								0.444 (0.318)
	Constant	-0.159 (0.553)	-0.750 (0.914)	-0.269 (0.544)	-0.213 (0.559)	0.0477 (0.697)	0.0829 (0.301)	15.54*** (0.687)	-0.211 (0.545)
	Observations	648	648	648	634	634	634	650	650
	Log-likelihood		-636.042						-694.714

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 1: Effects of maternal parttime work on sons' outcomes

Variables	Skipping school Probit model			Smoking at school Probit model			Bad grade at school Probit model			Years of education OLS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	Coeff.	Coeff.	Coeff.
mother's part-time work	0.0253 (0.0287)	0.0126 (0.0297)	0.00674 (0.0299)	0.0301 (0.0227)	0.0239 (0.0217)	0.0216 (0.0207)	0.0218 (0.0317)	-0.0124 (0.0337)	-0.0134 (0.0341)	-0.466*** (0.142)	-0.0204 (0.135)	-0.0350 (0.135)
father's educ: junior high		0.0283 (0.0477)	0.0416 (0.0500)		-0.0233 (0.0310)	-0.0189 (0.0310)		0.0330 (0.0537)	0.0427 (0.0550)		-0.476** (0.223)	-0.470** (0.223)
father's educ: training schl		-0.00872 (0.0906)	-0.0322 (0.0807)		-0.0859*** (0.0287)	-0.0906*** (0.0171)		-0.0916 (0.0834)	-0.102 (0.0785)		0.981*** (0.342)	0.994*** (0.333)
father's educ: junior college		0.171 (0.116)	0.196* (0.118)		0.0258 (0.0782)	0.0294 (0.0787)		0.0567 (0.114)	0.0659 (0.113)		0.734 (0.535)	0.707 (0.536)
father's educ: college and more		-0.0445 (0.0393)	-0.0548 (0.0387)		-0.0347 (0.0287)	-0.0392 (0.0263)		-0.00262 (0.0483)	-0.00691 (0.0484)		0.983*** (0.171)	1.009*** (0.171)
father's educ: don't know		0.00680 (0.0949)	0.0119 (0.101)		0.0373 (0.0833)	0.0355 (0.0836)		0.0474 (0.104)	0.0474 (0.103)		-0.179 (0.349)	-0.199 (0.347)
mother's educ: junior high		-0.0174 (0.0462)	-0.0214 (0.0457)		0.00443 (0.0367)	-0.000810 (0.0347)		0.0706 (0.0587)	0.0720 (0.0596)		-0.503** (0.235)	-0.480** (0.233)
mother's educ: training schl		0.0826 (0.0709)	0.0902 (0.0729)		0.00566 (0.0492)	0.0149 (0.0514)		0.0192 (0.0747)	0.0112 (0.0742)		0.191 (0.253)	0.176 (0.256)
mother's educ: junior college		-0.0121 (0.0588)	0.0179 (0.0644)		-0.0201 (0.0417)	0.00190 (0.0445)		0.0949 (0.0717)	0.103 (0.0730)		-0.155 (0.243)	-0.198 (0.245)
mother's educ: college and more		-0.0551 (0.0634)	-0.0476 (0.0656)		-0.0440 (0.0471)	-0.0403 (0.0451)		-0.107 (0.0683)	-0.101 (0.0701)		0.0787 (0.296)	0.0369 (0.297)
mother's educ: don't know		-0.0708 (0.0703)	-0.0580 (0.0763)		-0.0184 (0.0600)	-0.00603 (0.0641)		0.156 (0.103)	0.170* (0.103)		-0.473 (0.307)	-0.477 (0.306)
# of elder siblings		0.0754*** (0.0206)	0.0668*** (0.0196)		0.0265* (0.0157)	0.0197 (0.0149)		0.0280 (0.0227)	0.0213 (0.0232)		-0.286*** (0.0970)	-0.266*** (0.0963)
# of younger siblings		0.0110 (0.0217)	0.00826 (0.0209)		0.0175 (0.0173)	0.0153 (0.0160)		-0.00759 (0.0237)	-0.0117 (0.0240)		-0.153 (0.0980)	-0.135 (0.0980)
state of living		0.0185 (0.0211)	0.0162 (0.0214)		0.0279* (0.0160)	0.0252* (0.0153)		-0.000770 (0.0241)	-0.00348 (0.0243)		0.176* (0.0902)	0.168* (0.0913)
father's job: administrative		-0.00511 (0.0478)	0.00768 (0.0498)		-0.00155 (0.0395)	0.0118 (0.0407)		-0.0310 (0.0513)	-0.0235 (0.0524)		-0.201 (0.189)	-0.199 (0.190)
father's job: clerical		0.0777 (0.0642)	0.132* (0.0695)		0.0385 (0.0531)	0.0801 (0.0601)		0.0465 (0.0667)	0.0691 (0.0689)		-0.165 (0.250)	-0.220 (0.251)
father's job: sales		0.0766 (0.0595)	0.0826 (0.0604)		0.114** (0.0579)	0.126** (0.0578)		0.0183 (0.0605)	0.0211 (0.0615)		-0.619*** (0.234)	-0.651*** (0.235)
father's job: service		0.309*** (0.105)	0.340*** (0.106)		0.155 (0.1000)	0.173* (0.104)		0.175* (0.101)	0.171* (0.102)		-0.902** (0.406)	-0.887** (0.408)
father's job: manufacturing		0.0781 (0.0489)	0.0783 (0.0486)		0.0788* (0.0430)	0.0799* (0.0413)		0.156*** (0.0540)	0.154*** (0.0545)		-1.045*** (0.193)	-1.035*** (0.193)
father's job: transportation		0.134* (0.0704)	0.0864 (0.0654)		0.183** (0.0719)	0.162** (0.0682)		0.114 (0.0706)	0.0953 (0.0703)		-1.165*** (0.255)	-1.143*** (0.254)
respondent current age			-0.00466 (0.00315)			-0.00126 (0.00231)			-0.00370 (0.00356)			-0.00643 (0.0133)
problem school			0.131*** (0.0393)			0.0693** (0.0288)			0.0121 (0.0401)			0.160 (0.166)
tardy school			0.329*** (0.0608)			0.221*** (0.0545)			0.185*** (0.0610)			-0.751*** (0.202)
Constant										14.68*** (0.106)	14.67*** (0.368)	14.92*** (0.615)
Observations	811	811	811	811	811	811	805	805	805	813	813	813
Log-likelihood	-417.344	-395.713	-366.295	-298.065	-282.384	-263.351	-475.763	-447.447	-441.323			
R-squared										0.013	0.248	0.259

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 2: Effects of maternal parttime work on daughters' outcomes

Variables	Skipping school Probit model			Bad grade at school Probit model			Years of education OLS			
	(1)	(2)	(3)	(7)	(8)	(9)	(10)	(11)	(12)	
	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	Coeff.	Coeff.	Coeff.	
mother's part-time work	partwork	0.0285 (0.0232)	0.0235 (0.0236)	0.0201 (0.0231)	0.0296 (0.0282)	0.00144 (0.0290)	-0.00683 (0.0292)	-0.303*** (0.106)	-0.0944 (0.0979)	-0.122 (0.0991)
father's educ: junior high	faedcat1		0.0305 (0.0370)	0.0319 (0.0382)		0.117** (0.0460)	0.135*** (0.0473)	-0.673*** (0.133)	-0.643*** (0.133)	
father's educ: training schl	faedcat3		0.0836 (0.0982)	0.107 (0.102)		-0.0627 (0.0797)	-0.0546 (0.0828)	-0.368 (0.350)	-0.388 (0.345)	
father's educ: college and more	faedcat5		0.00878 (0.0349)	0.0177 (0.0340)		-0.000428 (0.0418)	0.00191 (0.0411)	0.265* (0.137)	0.267* (0.137)	
father's educ: don't know	faedcat6		0.217** (0.103)	0.217** (0.108)		0.117 (0.102)	0.145 (0.106)	-1.040*** (0.303)	-0.949*** (0.307)	
mother's educ: junior high	maedcat1		-0.00323 (0.0327)	-0.0131 (0.0320)		-0.0351 (0.0362)	-0.0251 (0.0369)	-0.238* (0.130)	-0.192 (0.130)	
mother's educ: training schl	maedcat3		-0.0204 (0.0432)	-0.0232 (0.0427)		-0.0123 (0.0530)	-0.0292 (0.0511)	0.400** (0.189)	0.350* (0.188)	
mother's educ: junior college	maedcat4		-0.0130 (0.0462)	-0.0143 (0.0441)		-0.117*** (0.0421)	-0.131*** (0.0388)	0.740*** (0.171)	0.675*** (0.174)	
mother's educ: college and more	maedcat5		0.00705 (0.0563)	0.00325 (0.0536)		-0.104** (0.0487)	-0.115** (0.0446)	1.101*** (0.205)	1.037*** (0.210)	
mother's educ: don't know	maedcat6		-0.0989** (0.0391)	-0.0901** (0.0400)		-0.00749 (0.0870)	-0.0107 (0.0868)	0.424 (0.307)	0.343 (0.310)	
# of elder siblings	eldersib		-0.0304** (0.0146)	-0.0260* (0.0148)		0.0306* (0.0181)	0.0312* (0.0183)	-0.160** (0.0675)	-0.169** (0.0668)	
# of younger siblings	youngersib		0.00181 (0.0158)	-0.00205 (0.0150)		-0.0221 (0.0193)	-0.0265 (0.0188)	-0.0937 (0.0642)	-0.0918 (0.0643)	
state of living	inc15		-0.0233 (0.0171)	-0.0124 (0.0169)		-0.0200 (0.0210)	-0.0204 (0.0209)	0.132** (0.0642)	0.113* (0.0654)	
father's job: administrative	fajobccat2		0.000936 (0.0362)	-0.00898 (0.0344)		-0.0687* (0.0381)	-0.0661* (0.0382)	0.217 (0.141)	0.230 (0.141)	
father's job: clerical	fajobccat3		-0.0288 (0.0411)	-0.0363 (0.0386)		-0.0353 (0.0495)	-0.0300 (0.0507)	0.136 (0.164)	0.155 (0.164)	
father's job: sales	fajobccat4		0.0109 (0.0479)	-0.00163 (0.0450)		0.0101 (0.0566)	0.000856 (0.0550)	0.0939 (0.192)	0.112 (0.193)	
father's job: service	fajobccat5		-0.00679 (0.0616)	0.00117 (0.0608)		0.169* (0.0962)	0.176* (0.0985)	-0.457* (0.242)	-0.482** (0.236)	
father's job: manufacturing	fajobccat6		0.00127 (0.0339)	0.00170 (0.0335)		-0.0194 (0.0389)	-0.0217 (0.0387)	-0.138 (0.138)	-0.151 (0.138)	
father's job: transportation	fajobccat7		-0.0180 (0.0444)	-0.0149 (0.0450)		-0.0199 (0.0542)	-0.0191 (0.0539)	-0.436** (0.180)	-0.423** (0.175)	
respondent current age	age			0.000211 (0.00235)			-0.00819*** (0.00293)		-0.0264*** (0.0102)	
problem school	probschool15			0.0871*** (0.0316)			-0.00306 (0.0333)		0.179 (0.113)	
tardy school	tardy15			0.234*** (0.0674)			0.117* (0.0649)		-0.308 (0.206)	
father's educ: junior college	faedcat4					-0.115 (0.0893)	-0.113 (0.0896)	0.685** (0.322)	0.752** (0.327)	
	Constant							14.20*** (0.0804)	13.88*** (0.263)	14.78*** (0.452)
	Observations	902	884	884	881	881	881	903	903	903
	Log-likelihood	-367.638	-356.845	-336.512	-468.891	-443.371	-436.447			
	R-squared							0.009	0.261	0.269

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1