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Does Taxation Affect Marriage and Family Planning Decisions?

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Abstract

This paper examines the effects of taxes on the timing of births and marriages in Japan using the "National Survey on Families" (Kazoku ni tsuite no Zenkoku Chousa). We estimate the average effect of the income tax deduction for dependents on the timing of births for those parents who are most likely to be affected by the tax deduction. Rather than estimating the average effects of the tax deduction on the timing of births for all parents, we focus only on those who are likely to be able to time their children's birth. In order to do this, we use a new control group, namely, those mothers whose age at the time of birth is 35 or older. It is assumed that for biological reasons they cannot time conception, whereas their younger counterparts are likely to time conception.

The analysis of the effects of income tax deductions for spouses on the timing of marriage is an understudied area. Little attention has been paid to the impact of taxes on individual marriage decisions. Like the analysis of the timing of births, we estimate the average effect of the income tax deductions on the timing of marriages for those women who are most likely to be affected by the tax deduction policy. For this reason, women who have never worked before are the focus of this paper's analysis.

There is some evidence to suggest that Japanese couples time conception to obtain some economic benefits associated with the deduction for dependents. However, the size of the effect is found to be rather small. Moreover, there is no evidence to suggest that the spouse deduction affects the decision of when to marry.

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ABSTRACT

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Keywords: births, family planning, marriage, taxation, timing.
JEL Classification Codes: J12, J13

1. INTRODUCTION

One key focus of economic analysis concerns how taxation and subsidies can affect and possibly distort human behavior. In Japan, the effects of the tax system on the labour supply decisions of women has been the subject of a deal of research (see Kohara, 2001). Many studies suggest that even though taxation and subsidies may not change actions, it can alter the timing of these actions. Some studies focus on capital gains realizations (Burman and Randolph, 1994), while others even go beyond conventional economics research and explore the impacts of taxes on the timings of birth, deaths, and marriage.

The usual formulation of taxation legislation can mean that a difference of one day can lead to significant differences in the tax to be levied or the subsidy to be paid by individuals. This difference of one day can leads to shifts in actual behavior by bringing actions forward or delaying actions, or by shifting how the timing is reported through changes in the timing of lodging documents.

There is research indicating that both the time of deaths and births responds to taxation regimes. Kopczuk and Slemrod (2003) investigate whether the timing of death is responsive to taxation, and find there is small 'death elasticity'. Dickert-Conlin and Chandra (1999) examine the impact of taxation in the U.S. on the timing of births and find that due to tax incentives, births are shifted from to the first week of January next year to the last week of December.

Similarly, Kureishi and Wakabayashi (2008) demonstrate that tax incentives cause births to be shifted from January to December in Japan. They use the information on 'shot-gun marriages' to control for whether the parents time conception or not. Assuming that non-shotgun married parents were more likely to time conception, babies from non-shotgun marriage are more like to be born in December than January compared to that of shot-gun marriage counterparts.

Gans and Leigh (2009) found that the introduction of a A$3000 "Baby Bonus" on 1 July 2004 in Australia caused births to be moved from June to July so that parents could become eligible for the Baby Bonus (the Australian tax year is July to June next year). They also find another shift in 2006 July when Baby Bonus was increased by A$1000.

Can we really control the timing of births and deaths? Kopczuk and Selmrod (2003) could not rule out the possibility of 'ex-post doctoring of the reported date of death.' Dickert-Conlin and Chandra (1999) and Gans and Leigh (2009) suggest that caesarean section (C-section) deliveries and inducement of labour play an important role in manipulating the timing of births. Furthermore, as

evidence of the manipulation of births, Gans and Leigh (2009) indicate that the babies born in July in 2004 are statistically heavier.

The findings of Kureishi and Wakabayashi (2008) are interesting considering the facts that C-section deliveries are less prevalent in Japan, and that more than 90 % of deliveries are full-term. They still find the tax incentives to give births in December without manipulating births at the point in deliveries. Their findings suggest that tax incentives even affect on timing conception.

Another stream of research relates to the effects of taxation on the timing of marriages. If the timing of birth and death are in fact controllable and respond to taxes, we might expect that impacts of tax incentives should be more prevalent in timing of marriage. Sjoquist and Walker (1995) find empirical evidence that tax incentives cause the shift of the timing of marriage from the end of the year to the beginning of the next year. Gelardi (1996) finds that people changed the timing of their marriage in response to changes of marital deductions in Canada and England and Wales,. However, these studies on marriage timing are based highly aggregated time-series data, and do not directly examine individual behavior.

Alm and Whittington (1997) use the Panel Study of Income Dynamics (PSID) to investigate the relationship between income taxes and the timing of marriage. They find that the marriage penalty in the US is associated with the timing of marriage, and that people delay their marriage due to the marriage penalty (For a survey on the marriage penalty, see Alm et al.(1999)). However, Alm and Whittington (1997) argue that the magnitude of the effect is small.

This paper will revisit the analyses of the effects of taxation on the timing of births and marriages using Japanese data obtained from the “National Survey on Families” (Kazoku ni tsuite no Zenkoku Chousa). This paper differs from the previous studies in the effect of taxes on fertility in three aspects: the use of a new control group, the inclusion of temperature and photoperiods to account for non economic factors affecting timing, and a treatment of measurement errors.

First, our primary interest is in the average effect of the tax policy on the timing of births for those parents who are affected by the tax. So, rather than estimating the average effects of the tax on the timing of births for all parents, we to focus on those people who are likely to time their births. Dickert-Conlin and Chandra (1999) analysis is weak in this aspect. Kureishi and Wakabayashi (2008) have dealt with this point by focusing their analysis on shotgun married parents and non-shotgun married parents. Their argument is that non-shotgun parents are likely to time conception;

Some recent research suggests that there is a need to be cautious when dealing with the seasonality of births. Buckles and Hungerman (2008) find that winter born children are more likely to be born to mothers who are younger, less educated and are more likely to be single. They argue that family background can explain a half of the relationship between adult outcomes and the seasonality of births. Buckles and Hungerman demonstrate that the use of the seasonality of birth as an instrument may be problematic. The argument of Buckles and Hungerman (2008) is very important for the identification strategies used in the estimation of the effect of taxes on the timing of birth. The findings of Kureishi and Wakabayashi (2008) may be biased due to the relationship between the seasonality of births, adult outcome (shotgun marriage), and family background characteristics.

Hence, we propose a new control group, that is, those mothers whose age at the time of birth is 35 or more. According to Dunson et. al. (2002), women's fertility starts to decline in the late 20s and it substantially decreases by the late 30s. It is assumed that if the mother’s age at the time of birth is 35 or more, they cannot time conception, whereas younger counterparts are likely to be able to time conception. Since one of Kureishi and Wakabayashi’s (2008) findings is that in order to time births, Japanese time conception rather than manipulating deliveries by C-section, this control group is more appropriate to examine the issue.

Second, this paper includes two important variables in the analysis: temperature and photoperiods at the time of conception. Lam and Miron (1996) indicate that these two variables play significant roles in fertility, yet these variables are not adequately treated in previous economic studies of timing of births.

Third, in order to examine the robustness of the findings of Kureishi and Wakabayashi (2008), we minimize the measurement errors by imposing stricter sample selections rules Respondents who are self-employed and whose husband’s age is 60 or more are excluded when estimating a husband’s income for the purpose of computing the value of the potential tax deduction for a child.

The potential effects of taxation on the timing of marriage is still a rather understudied area, especially when it comes to the analysis of individual decision making using microdata. In addition, as far as we know, this study is the very first study in Japan on the timing of marriage. If people even try to control the timing of births to obtain the benefits of a tax deduction, they should try to do so for the timing of marriage as it is much easier to control the timing of marriage compared to timing of births. Furthermore, if the couple can claim the full deduction, the value of the spouse deduction is much larger than the value of the dependent allowance. This study concentrates on those people

who are most likely affected by the spouse allowance by focusing on couples where the wife has never worked before. Obviously, this group of women with no work experience did not have income at the time of marriage, and therefore, the couple must have passed the income test imposed to gain the full spouse deduction.

A great deal of attention has been paid to the relationship between the spouse deduction and female labour supply in Japan. As the spouse deduction is income-tested, there is evidence that married women adjust their labour supply so that they can avoid becoming liable for taxation, and their husbands can be eligible for the spouse deductions (for example, Abe and Ohtake (1995), Higuchi (1995), and Kohara (2001)). The empirical evidence suggests that married women react to the existence of the spouse deduction in the labour market. However, there is no study to examine how the spouse deduction might have impacted on the decision of when to marry.

In the United States, due to the income splitting, there is a huge range of variation in the impact of marriage on the tax liabilities so that there can be a marriage tax or a subsidy depending on timing and the income levels of the individuals concerned. On the other hand, the Japanese spouse deduction is a straight forward: pure marriage subsidy. Thus, it should be easier to estimate the average effect of the marriage subsidy on the timing of marriage.

Our empirical results suggest that there is some evidence that Japanese couples time conception to gain the dependent deduction. However, even if this effect is robust, the magnitude of the effect is very small. In contrast, there is no evidence to suggest that the spouse deduction affects the decision of when to marry.

Section 2 provides an outline of the Japanese personal income tax. Section 3 discusses the empirical models used to estimate the effects of taxation on the timing of births and marriages, while section 4 details the definitions of the variables used and the data sources. Estimation results are reported in section 5, and section 6 contains a conclusion.

2. JAPANESE INCOME TAX

Under the Japanese Income Tax Law, individual income earners are subject to income tax. The income tax is computed on the basis of annual income tax in a tax year defined as January to December. Couples are not able to file jointly in Japan. There are basically two steps to compute an individual's income tax. First, eligible deductions and allowances are deducted from the individual's annual income. These deductions include deductions for dependents and spouse. What remains after

this deductions is taxable income. Second, progressive income tax rates apply are then applied to this taxable income to determine an individual's required tax payments. Table 1 summarizes how the dependent allowance, spouse allowance and tax rates have changed in Japan between 1964 an 2003.

[Table 1 around here]

The deduction for dependents can be made if the taxpayer has children or other relatives who depend on the taxpayer for their livelihood and the dependent's income is 380,000 yen (in 2003) or less. If this is the case, the taxpayer can claim the 380,000 yen deduction for each dependent. As a new born baby obviously has no income, the taxpayer can claim the deduction for a newly born baby.

An income test for the spouse deduction is more complicated than the deduction for a new born baby. The amount of the deduction varies according to the wife's income. For example, in the 2003 tax year, if the wife's income is below 700,000 yen, her husband is eligible for the full spouse deduction. If the wife's income exceeds the 700,000 yen threshold, the deduction is gradually reduced and becomes 0 when the wife's income exceeds 1.41 million yen.

It is important to stress that the eligibility for dependent or a spouse deduction is determined by the status of a household on the day prior to the beginning of the relevant tax year, namely, December 31. For example, if a baby is born on December 31, the couple is eligible for the deduction for a new born baby for the next tax year starting on the following day, whereas if the baby is born on January 1, the couple is not eligible for the dependent deduction for that tax year, but will be eligible for the next tax year starting on January 1 of the following year. Thus, there may be a tax incentive to have a baby by the end of the year rather than to have a baby early in the next year.

Similarly if a couple gets married on December 31 and the wife's income in the next tax year is below 700,000 million yen, the husband is eligible for the full deduction for spouse for the next tax year starting on the following day, January 1, whereas if the same couple gets married on January 1, the husband is not eligible for the spouse allowance for that year regardless of his spouse's income. So everything else being equal couples have a tax incentive to marry by the end of calendar year rather than delaying their marriage in an early next year.

The key point to note for children born in January is that this tax regime does not mean a shift of the deduction payment for one year for the parents who have January born children. December born babies can get one extra year of deduction compared to January born babies. To be precise, parents with babies who are born in January, February or March are more likely to lose one year value of

deduction compared to the parents of babies who are born in December in the previous year.

This is due to the Japanese education system and the smooth transit of new graduate to the labour market after completing high school or university. The school and business calendars start from April 1 to March 31. This means that the babies born between April and December and the babies born between January and March in the following year belong to the same grade at school, graduate together, are hired together, so that parents will lose the deduction for these children at the same time regardless of which month they were born in.

When high school graduates or university graduates complete their education in March, the majority of them either have a job or go on to do further education. Figure 1 shows how high school graduates fare after their graduation. The employment rate for high school graduates has been declining. Instead, the proportion of graduates going to university has been increasing. These two groups, high school students who start working or who go on to university, make up the majority of high school graduates. The remaining high school graduates go on to enroll in a technical college or become unemployed.

[Figure 1 around here]

Figure 2 shows the employment rate for new college graduates in Japan. The majority of the new graduates smoothly transit from university to the labour market. The rest of the university graduates either go on to enroll in a post-graduate course or become unemployed.

[Figure 2 around here]

As the Japanese financial calendar year starts from 1 April, the vast majority of new employees start their new jobs from 1 April. This means both babies born between April to December in year t and babies born between January and March in year t+1 loose their dependent status when they finish their education and start working in year t+18 or year t+22. In other words, babies born between January and March cannot regain an additional year of deduction in year t+22 which they lost in year t. This is summarized in Table 2.

[Table 2 around here]

Medical Expenses

Another potentially important tax incentive is the deduction for medical expenses. The amount of

deduction for medical expenses is computed by the following fashion. First, the total medical expenses of the taxpayer and his/her spouse and dependents between January 1 and December 31 are added up. The claimed insurance coverage is then subtracted from the total medical expenses. Furthermore, the smaller amount of 100,000 yen or 5 % of total net income is subtracted from the medical expenses. The remaining amount is the amount of deduction for medical expense.

As the deduction for medical expenses is computed on the basis of medical expenses between January 1 and December 31, there is a tax incentive to concentrate the household medical expenses in one year. Thus, rather than having a baby in the first quarter, it may be beneficial for parents to have their baby in the fourth quarter.

3. MODEL

The previous section discussed the key provisions of the Japanese income tax system. In order to examine whether there is a tax incentive to have a baby (or to marry) later in the year rather than earlier in the next year, first, we introduce the following benchmark model.

$$Q4\_birth^{*} = \delta_{10} + \delta_{11} deduction + X\delta + \varepsilon_{11} \qquad (1\text{-}1)$$

$$Q4\_birth = \begin{cases} 1 \text{ if } Q4\_birth^{*} > 0 \\ 0 \text{ otherwise} \end{cases}$$

where *Q4_birth* is a binary variable which takes one if parents have their first baby in the fourth quarter, and zero if they have their first child in the first quarter. The variable *deduction* is the potential tax deduction for a new born baby. From the earlier discussion, we expect that δ_{11}>0. δ_{11} can be interpreted as the average tax effects on the timing of birth for all parents. The vector X includes other explanatory variables: mother's age at the time of birth, mother's education in years, temperature and photoperiods at the time of conception, and city and regional dummies. Mother's age at the time of the birth is expected to have a negative effect as late child-bearing makes it more difficult for mothers to time conception. The mother's level of education is included as an explanatory because it is assumed that the higher a mother's education level is likely to lead to a better knowledge and understanding of the tax system. Thus, we expect this variable to have positive effect.

The model in (1-1) is similar to Dickert-Conlin and Chandra's (1999) model except that their

analysis is more local in that they only compare births in the last week of December and in the first week of January. We, on the other hand, compare the fourth quarter birth to the first quarter birth. This is done to ensure we have enough observations for our analysis.

Previous studies suggest that temperature and photoperiods play important roles in conception (for example, Lam and Miron (1996)). In spite of such empirical evidence, these effects are all but ignored in the economic analyses of the timing of births. We explicitly account for these impacts in the model.

Finally, we include city size dummies and regional dummies to control for cultural and geographical effects. These are also expected to control for the availability of obstetricians and gynecologists in the area where the respondent lives.

Next, we introduce the following model to extend the benchmark equation (1-1).

$$\begin{aligned} Q4\_birth^* &= \delta_{10} + \delta_{11} deduction + \delta_{12} childbearing34 \\ &+ \delta_{13} deduction \times childbearing34 + X\delta + \varepsilon_{11} \end{aligned} \tag{1-2}$$

$$Q4\_birth = \begin{cases} 1 \text{ if } Q4\_birth^* > 0 \\ 0 \text{ otherwise} \end{cases}$$

Equation (1-2) includes the additional variables childbearing34 and the interaction term, deduction*childbearing34. *childbearing34* is a binary variable which takes unity if the mother's age at the time of her first child is 34 or less, and takes zero if the mother's age at the time of her first child is 35 or more. The idea in using this variable is to view mothers who gave birth at the ages younger than 34 as a treatment group and the mothers who gave birth to their first child at the age of 35 or more as a control group. δ_{13} is the tax effect for mothers who gave birth at younger age who are likely to time conception, and $\delta_{11} + \delta_{13}$ are the average effect on the timing of birth for mothers who gave birth at younger age. We expect $\delta_{11} + \delta_{13} > 0$.

Dunson et. al. (2002) suggest that women's fertility decreases substantially by the late 30s. It is assumed therefore that if mother's age at the time of birth is 35 or more, they cannot time conception whereas younger counterparts are likely to time conception. We also use an alternative variable, *childbearing29*. *childbearing29*, is a binary variable which takes the value unity if the mother's age at the time of her first child is 29 or less, and takes zero if the mother's age at the time of her first child is 30 or more.

In their analysis of the effect of the dependent deduction on the timing of births, Kureishi and Wakabayashi (2008) use divide marriages into three groups: shotgun-marriages, non-shotgun marriages, and marriages where it is not clear whether they are shotgun marriages. Firth births in shotgun marriages are used as the control group and first births in non-shotgun-marriages are used as the treatment group. Kureishi and Wakabayashi argue that shotgun-married parents cannot time conception as they did not plan to have the baby. On the other hand, non-shot-gum married parents are able to time conception as they plan their baby in advance.

While this is an interesting idea, we believe that our choice of control and treatment groups has two advantages over their comparison of shotgun-married-parents and non-shotgun-married parents. First, as discussed earlier, Buckles and Hungerman (2008) contend that winter born children are more likely to be born to mothers who are younger, less educated, and more likely to be single. Therefore, the use of comparison of shotgun-married-parents and non-shotgun-married parents may cause bias due to the relationship between the seasonality of birth, adult outcome (shotgun marriage), and family background characteristics. Second, in order to examine whether Japanese time conception rather than manipulation deliveries by C-section to obtain tax benefits, this control group is more appropriate to explicitly examine the issue.

To examine the effects of taxes on the decision of when to marry, we use the following benchmark model.

$$Q4\_marriage^{*} = \delta_{20} + \delta_{21} s\_deduction + X\delta + \varepsilon_{21} \qquad (2\text{-}1)$$

$$Q4\_marriage = \begin{cases} 1 \text{ if } Q4\_marriage^{*} > 0 \\ 0 \text{ otherwise} \end{cases}$$

where *Q4_marriage* is a binary variable which takes one if the couple gets married in the fourth quarter, and zero if the couple gets married in the first quarter. The variable s_deduction is the potential tax deduction for spouse. δ_{21} is the average tax effects on the timing of marriage for all couples, and we expect δ_{21}>0. This model is similar to Alm and Whittington's (1997) model as they also compare the fourth quarter marriage to the first quarter marriage. *Q4_marriage* is a binary variable which takes one if couples married in the fourth quarter and zero if they married in the first quarter.

The vector X includes husband's age and husband's education level. Since the beneficiary of the spouse deduction is often the husband, it is assumed that the decision of when to marry is based more on husband's characteristics. However, it is worthwhile noting that when we used the wife's

characteristics to estimate models, we obtained similar results.

As is the case for the timing of birth equation (1-2), city size dummies and regional dummies are included to control for cultural and geographical effects. Moreover, in order to consider seasonality of wedding, we also include as explanatory variables the average temperature and photoperiods for the month of marriage in the prefecture where they live.

Next we propose the following model to further extend the equation (2-1).

$$Q4\_marriage^{*} = \delta_{20} + \delta_{21} s\_deduction + \delta_{22} never\_worked + \delta_{23} s\_deduction \times never\_worked + X\delta + \varepsilon_{22} \quad (2\text{-}2)$$

$$Q4\_marriage = \begin{cases} 1 \text{ if } Q4\_marriage^{*} > 0 \\ 0 \text{ otherwise} \end{cases}$$

The variable *never_worked* is a binary variable taking the value unity if the wife has never worked and zero otherwise. That is, we introduce as a treatment group, couples whose wife never worked before. As discussed in section 2, the eligibility and the amount of the spouse deduction varies according to the wife's income. If the wife is employed in a full-time position, she is more likely to exceed the threshold for the spouse deduction. Furthermore, if she was employed in a part-time position, the amount of the deduction could vary. In equation (2-2), δ_{23} is the tax effect for the couples whose wife has no work experience and therefore, no income at the time of marriage. They are more likely to time marriage than those couples whose wife has some work experience. $\delta_{21} + \delta_{23}$ are the average effect on the timing of marriage for couples whose wife has no work experience. We expect $\delta_{21} + \delta_{23} > 0$.

In order to estimate the potential amount of the spouse deduction, we need information on the wife's income at the time of marriage. However, it is difficult to estimate the wife's income with our data set as it only contains the current income and employment status. Women often quit or change their job at the same time as major events in their life such as marriage and childbearing. According to our data set, many women are currently not in the labour force nor in full-time employment.

Thus, we only consider the extreme case, that is, for those women who has never worked before. Those who are most affected by the tax incentive are women who had no income at the time they marred. We can be sure that those women who have never worked before definitely had no income at the time of marriage. In this case, their husbands can receive full amount of deduction.

The advantage of using this method is that we can avoid having measurement errors associated with estimating the amount of spouse deduction as they can receive the full deduction. Moreover, these women are free from the effects of the bonuses paid to Japanese workers in December. In Japan, many companies provide bonuses in summer (usually July) and winter (usually December). This may distort our estimation as there is an incentive for women to resign from their jobs when they marry after receiving their year end bonus.

4. DATA

The data for this secondary analysis, "National Survey on Families (NSF)" (Kazoku ni tsuite no Zenkoku Chousa) for 1999 and 2004 conducted by the National Family Committee of the Japan Society of Family Sociology was provided by the Social Science Japan Data Archive, Center for Social Research and Data Archive, Institute of Social Science, The University of Tokyo. These two surveys provide data relating to are drawn from the 1998 and 2003 "National Survey on Families (NSF)" (Kazoku ni tsuiteno Zenkoku Chousa). These surveys were conducted by the National Family Committee of the Japanese Society of Family Sociology and the Social Science and the Social Science Japan Data Archive, Information Center for Social Science Research on Japan, Institute of Social Science, University of Tokyo. The surveys were conducted in January 1999 and 2004 respectively. In the 1999 survey, 10,500 individuals between 28 and 77 years old at the time of December 1998 were surveyed with a response rate of 66.52% (6985 responses). In the 2004 survey, 10,000 individuals between 28 and 77 years old at the time of December 2003 were surveyed and the response rate was 63.02% (6302 responses).

Both surveys ask respondents about the year and month of their latest marriage and year and month of the birth of their first child. The 1999 survey asks year and month of the children up to their fifth child, while the 2004 survey asks year and month of children up to their third child. Following Krureishi and Wakabayashi (2008) we focus only on the first child. All the variables used in the analysis come from NSF except the information on temperature and photoperiods. The monthly prefectural information on temperature and photoperiods comes from the Japan Meteorological Agency. While the 1999 survey provides information on the prefecture where the respondent currently lives, the 2004 survey does not, so we can only use the information on temperature and photoperiods for the 1999 survey.

There are several variables that need to be constructed/estimated for our analysis, father's (husband's) income, and the value of the deduction. In order to compute the potential tax deduction for a new born baby, we need father's income at the time of birth of the first child. The NFS provides

information only on current income and occupational information, but does not provide information on father's income at the time of birth of the first child. We therefore estimate the father's income using the method suggested by Kureishi and Wakabayashi (2008). That is, we first estimate the wage equation for fathers using the father's current income information. Here the log of income is regressed on age, age square, education dummies, firm-size and occupational dummies. The predicted value of the father's income at the time of birth of his first child is computed by using his age the time of the birth of his first child. To account for individual effects, we added a half of the residual. The estimated income is converted into the nominal income at the time of the birth.

In order to minimize measurement errors, in estimating the wage equation, respondents who are self-employed and/or whose husband's age is 60 or more are excluded. The incomes of the self-employed people are heavily influenced by business-cycle. Elderly workers are likely to have changed their job after their mandatory retirement. These factors are believed to cause measurement errors.

The process for estimating the husband's income at the time of marriage is essentially In this case, we compute the predicted value of husband's income at the time of marriage using his age at the time of marriage.

The next step is to compute the value of the tax deduction. The National Tax Agency Annual Statistics (NTAAS) (Kokuzei-cho Toukei Nenpou-sho) provides information on the marginal tax rate for each income group, the number of brackets and per-capita average amount of taxable income for each income group. To compute taxable income accurately, we need the information on other deductions and allowances such as medical expenses, insurance payments, and the number of elderly dependents, but the NFS does not contain such information. Hence, we convert the estimated father's income or husband income into the per-capita average amounts of taxable income which are listed in the NTAAS. The average amount of deduction for a dependent for this taxable income category can then be obtained from NTAAS, and it is multiplied by the marginal income tax rate according to the average per-capita amounts of taxable income. Finally, the deduction is converted into the 2003 price value.

There is one important caveat to be noted regarding the temperature and photoperiods data used, it is not the data at the time of conception but that of birth. This complicates the lagged effects. It is important to note that the data on the temperature is imprecise. First, as we do not have information on the either the respondent's location at the time of conception or birth, we assume that the present residence of the respondents is the same as at the time of conception. Furthermore, the information

on prefectural temperatures is the temperature for the capital of the prefecture, and so misses differences in temperatures within a prefecture.

Conception might have occurred 8, 9, or 10 months before the observed month of birth. However, in obtaining the temperature and photoperiod data, we use 10 months before the observed month of birth. In Japan, the Birth Statistics (SB; Shusshou ni kansuru Toukei) suggest that approximately 94 per cent of deliveries are full term, which is between 36 and 43 weeks. Moreover, Lam and Miron (1996) indicate that 9 and 10 months before the observed month of birth are statistically significant in their analysis of the month of birth.

Our sample is confined to respondents who satisfy five criteria. First, we focus on respondents who have at least one child. This criterion is self-explanatory as we focus on the deduction on a new born baby. Second, respondents who have been divorced or widowed are excluded. Divorcees or widows may have children from their previous marriage, but NFS does not contain the information on their previous marriage. If the respondent is female, there is no information on her previous husband, and therefore, it is impossible to estimate the father's or husband's income. Third, the sample is confined to respondents whose husbands have an income. This criterion is set to estimate father's income or husband's income. Fourth, to be consistent with Kureishi and Wakabayashi (2008), we excluded respondents whose babies were born before 1964. Kureishi and Wakabayashi (2008) imposed this sample selection in order to estimate the incomes of the self-employed. However, we excluded the self-employed form the sample in estimating father's or husband income. Finally, we exclude all observations which does not contain all the information required in estimation. Descriptive statistics are summarized in Tables 3 and 4 for the samples used in the analysis of timing of births, and in Tables 5 and 6 for the samples used in the analysis of the timing of marriages. These tables are made corresponding to the sample selection.

[Table 3 around here]

[Table 4 around here]

[Table 5 around here]

[Table 6 around here]

5. RESULTS

5.1 Timing of Birth

Table 7 reports the estimation results of benchmark model (1-1). In equation (1) on Table 7 *deduction* is positive and statistically significant. The magnitude of the coefficient is nevertheless rather small, as a 1000 yen increase in the value of dependent deduction increases the probability of

the fourth quarter birth by 0.002 per cent. However, after controlling weather variables, the effects disappear in model (2) in Table 7.

[Table 7 around here]

Table 8 summarizes the estimation results of late childbearing model (1-2). As discussed earlier, our primary interest is determine whether $\delta_{11} + \delta_{13} > 0$. In other words, whether the sum of the coefficients of *deduction* and *deduction*childbearing34* (or *deduction*childbearing29*) are positive and statistically significant. However, in the expanded models (1) and (2) in Table 8, the coefficients of interests are not significant. Hence, we conduct the Wald tests of the null hypothesis $\delta_{11} + \delta_{13} = 0$ for models (1) and (2) in Table 8. These tests reject the null hypothesis, 5.96 (p=0.0147) and 3.21 (p=0.0775) respectively.

[Table 8 around here]

Thus, we dropped *deduction* and re-estimated the model. The estimated results for the models (3) and (4) show that the coefficients of the cross-term variables *deduction*childbearing34* and *deduction*childbearing29* are positive and statistically significant. Again, the magnitudes are very small- 0.002 and 0.001 respectively.

These cross-term effects seem to be robust after controlling for weather as is seen in models (5) and (6). Although the coefficient of *deduction* is not statistically significant, the coefficient of the cross-term variable, *deduction*childbearing34*, is positive and statistically significant after including temperature and photoperiods. This is also the case when we use the extreme case where we compare those women who gave birth at the age of 29 or younger to those women who gave birth at the age of 35 or older. However, the magnitude of the coefficient is small for the both case. 1000 yen increase in deduction will increase the probability of giving birth in the fourth quarter rather than the first quarter by 0.008 per cent point.

Looking at the other explanatory variables, we find that temperatures and photoperiods at the time of conception are consistently significant variables. That is, the external environment at the time of conception play a crucial role in pregnancy. Mother's education level is also positive and statistically significant when we control for temperature and photoperiods. This is consistent with our hypothesis that well-educated mother may have more knowledge and a better understanding of the tax system, and, therefore, they choose to give birth in the fourth quarter.

Timing of Marriage

Table 9 reports the estimation results of benchmark model (2-1). In equation (2) on Table 9, the deduction is found to have a negative and statistically significant effect. However, this contradicts our expectations. Husband's education level seems to correspond with expectations, namely, that the higher the education level is, the better they know and understand the tax system leading to a higher probability of choosing to marry in the fourth quarter.

Table 10 summarizes the estimation results of the wife's work experience model (2-2). As discussed earlier, our primary interest is whether $\delta_{21} + \delta_{23} > 0$. Again, the coefficient of deduction is negative and statistically significant in equation (2) in Table 10. Thus, it can be concluded that there is no tax incentive to shift marriages from the first quarter to the fourth quarter.

[Table 9 around here]

[Table 10 around here]

6. CONCLUSION

This paper has examined the effects of taxes on the timing of births and the timing of marriages using a Japanese micro data. We estimate the average effect of the income tax on the timing of births for those parents who are affected by the tax. We propose a new control group, that is, those mothers whose age at the time of birth is 35 or older. It is assumed that they cannot time conception, whereas younger counterparts are likely to time conception.

The analysis of the effects of the income tax on the timing of marriage is an understudied area where little attention has been paid to the impact of taxes on individual's decisions to marry and the timing of their marriage. Like the analysis of the timing of births, we estimate the average effect of the income tax on the timing of marriages for those women who are most likely to be affected by the tax policy, namely, women who have never worked before.

There is some evidence to suggest that Japanese couples time conception to gain the dependent deduction. However, the effect of the magnitude of the coefficient is very small. Moreover, there is no evidence to suggest that the deduction for spouse affect the decision of when to marry.

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Figure 1: The Career Path of High School Graduates

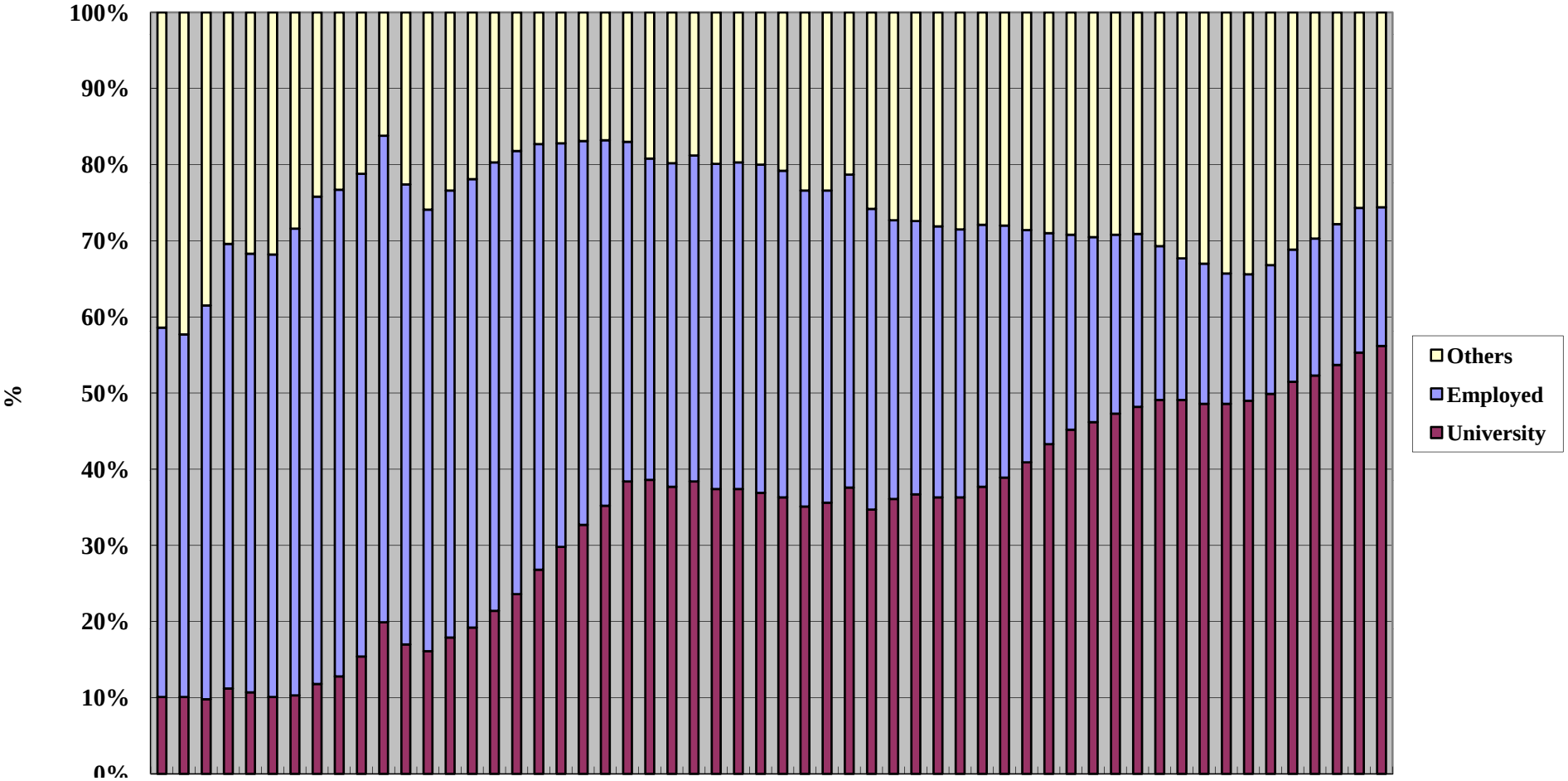

Figure 2: Employment Rate for New University Graduates

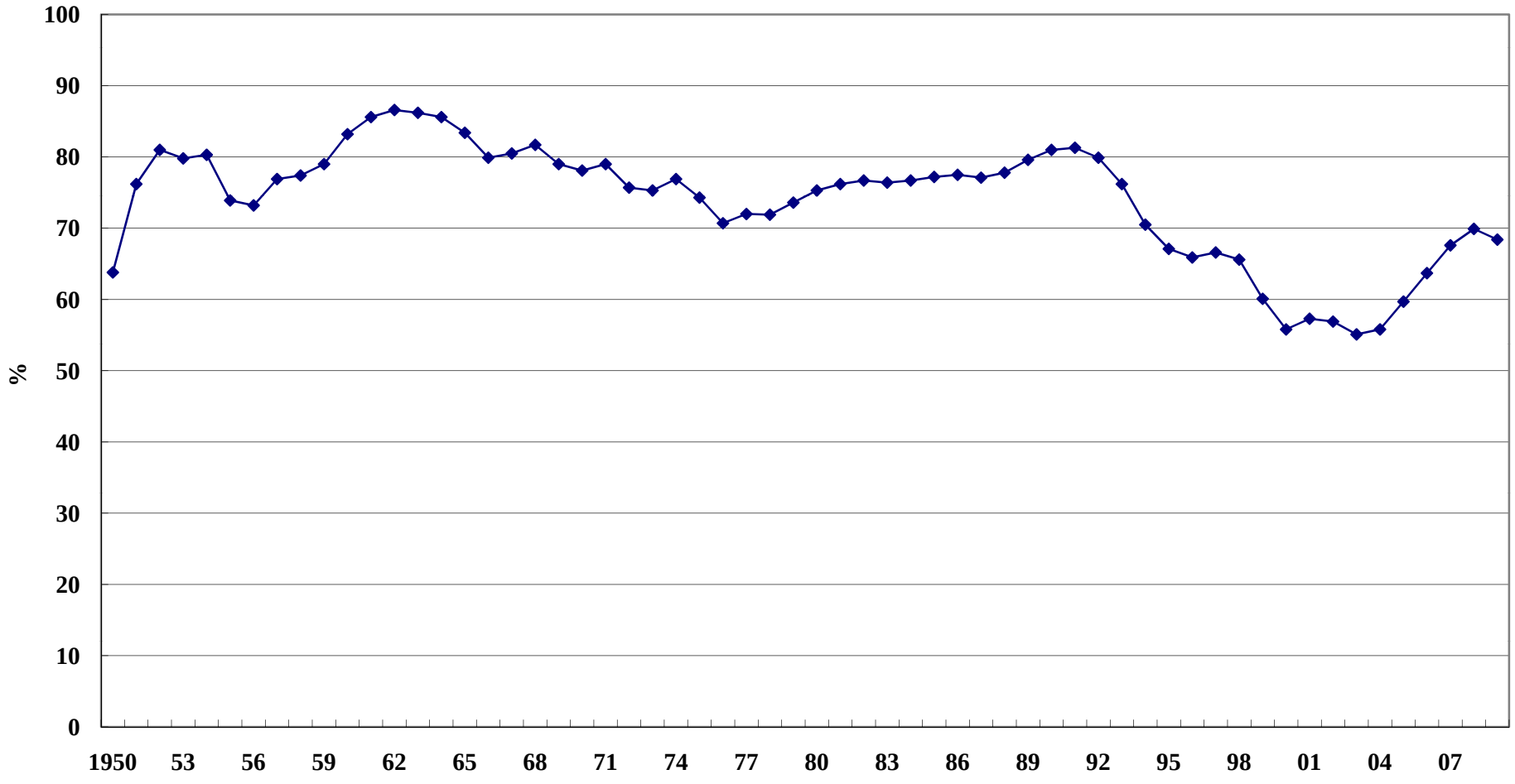

TABLE 1: ESSENTIAL ELEMENTS OF JAPANESE INCOME TAX SYSTEM

Year	Deduction for Dependent	Deduction for Spouse	Minimum Marginal Tax Rate	Maximum Marginal Tax Rate	Number of Tax Brackets
1964	40,000	108,800	8%	75%	15
1965	50,000	117,500	8%	75%	15
1966	60,000	127,500	8.50%	75%	15
1967	70,000	145,000	9%	75%	15
1968	80,000	157,500	9.50%	75%	15
1969	100,000	167,500	10%	75%	15
1970	120,000	177,500	10%	75%	19
1971	140,000	195,000	10%	75%	19
1972	140,000	200,000	10%	75%	19
1973	160,000	207,500	10%	75%	19
1974	240,000	232,500	10%	75%	19
1975–1976	260,000	260,000	10%	75%	19
1977–1982	290,000	290,000	10%	75%	19
1983	300,000	300,000	10%	75%	19
1984–1986	330,000	330,000	10.50%	70%	15
1987	330,000	492,500	10.50%	60%	12
1988	330,000	495,000	10%	60%	6
1989–1994	350,000	700,000	10%	50%	5
1995–1998	380,000	760,000	10%	50%	5
1999–2003	380,000	760,000	10%	37%	4

Notes: Deductions are nominal. The spouse deduction is computed for the case that the spouse has no income.

Source: National Tax Agency, National Tax Agency Annual Statistics (Kokuzaikyoku Nenpo), various issues.

TABLE 2: The Eligibility for the Dependent Deduction

	Eligibility for deduction			
Babies born in	t-1	t	t+1 to t+21	t+22
April to December in year t-1	ineligible	eligible	eligible	no deduction
January, February or March in year t		ineligible	eligible	no deduction

Assumes that child loses its dependence status 22 years after being born.

TABLE 3
DESCRIPTIVE STATISTICS1

		All observations (n=1623)		1998 Survey (n=842)	
Variable	**Description**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Q4_birth	Dummy variable equal to 1 if the baby is born in October, November, or December, 0 otherwise.	0.426	0.495	0.416	0.493
deduction	Potential tax deduction for a new born baby in 1000 yen as per the 2003 level	56.739	21.006	57.349	22.409
mother_age	Mother's age at the time of birth	26.935	3.540	26.489	3.364
child_bearing34	Dummy variable equal to 1if mother_age is 34 or less, 0 if mother age is 34 or more.	0.967	0.178	0.979	0.145
mother_educ	Mother's years in education	12.895	1.751	12.685	1.814
city_size1	Dummy Variable equal to 1 if the respondent lives in one of 14 major cities, 0 otherwize.	0.198	0.398	0.173	0.379
city_size2	Dummy Variable equal to 1 if the respondent lives in a city whose polulation size is 100,000 or more, 0 otherwize.	0.389	0.488	0.406	0.491
city_size3	Dummy Variable equal to 1 if the respondent lives in a city whose population size is less than 100,000, 0 otherwize.	0.197	0.398	0.201	0.401
city_size4	Dummy Variable equal to 1 if the respondent lives in a villege, 0 otherwize.	0.216	0.411	0.220	0.414
region1	Dummy Variable equal to 1 if the respondent lives in Hokkaido, Aomori, Iwate, Miyagi, Akita, Yamagata or Fukushima, 0 otherwize.	0.113	0.316	0.078	0.269
region2	Dummy Variable equal to 1 if the respondent lives in Saitama, Chiba, Tokyo, Kanagawa, Ibaraki, Tochigi, Gunma, Yamanashi or Nagano, 0	0.328	0.470	0.318	0.466
region3	Dummy Variable equal to 1 if the respondent lives in Niigata, Toyama, Ishikawa, or Fukui, 0	0.045	0.207	0.043	0.202
region4	Dummy Variable equal to 1 if the respondent lives in Gifu, Shizuoka, Aichi, or Mie, 0 otherwize.	0.145	0.352	0.144	0.351
region5	Dummy Variable equal to 1 if the respondent lives in Shiga, Kyoto, Osaka, Hyogo, Nara or Wakayama, 0 otherwize.	0.163	0.369	0.181	0.385
region6	Dummy Variable equal to 1 if the respondent lives in Tottori, Shimane, Okayama, Hiroshima, or Yamaguchi, 0 otherwize.	0.068	0.252	0.075	0.263
region7	Dummy Variable equal to 1 if the respondent lives in Tokushima, Kagawa, Ehime, or Kochi, 0	0.038	0.192	0.053	0.225
region8	Dummy Variable equal to 1 if the respondent lives in Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima or Okinawa, 0 otherwize.	0.100	0.300	0.108	0.311
temp	Temperature at 10 months before the birth in prefecture j			9.451	5.136
photo	Photoperiod at 10 months before the birth in			173.851	39.018

TABLE 4
DESCRIPTIVE STATISTICS 2

	All				1998 Survey			
	mother_age<30 (n=1296)		mother_age>34 (n=53)		mother_age<30 (n=705)		mother_age>34 (n=18)	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Q4_birth	0.431	0.495	0.509	0.505	0.420	0.494	0.556	0.511
deduction	55.659	19.913	66.003	23.495	56.359	21.003	64.805	29.490
mother_age	25.568	2.124	37.491	2.539	25.383	2.169	37.444	2.617
mother_educ	12.755	1.742	13.208	1.833	12.609	1.815	12.500	1.978
city_size1	0.185	0.389	0.340	0.478	0.166	0.372	0.278	0.461
city_size2	0.390	0.488	0.321	0.471	0.406	0.491	0.333	0.485
city_size3	0.204	0.403	0.170	0.379	0.203	0.402	0.222	0.428
city_size4	0.221	0.415	0.170	0.379	0.226	0.418	0.167	0.383
region1	0.113	0.317	0.170	0.379	0.084	0.277	0.167	0.383
region2	0.296	0.457	0.434	0.500	0.289	0.454	0.389	0.502
region3	0.047	0.212	0.038	0.192	0.044	0.205	0.056	0.236
region4	0.157	0.364	0.075	0.267	0.155	0.362	0.111	0.323
region5	0.172	0.378	0.113	0.320	0.190	0.393	0.111	0.323
region6	0.074	0.262	0.038	0.192	0.078	0.268	NA	NA
region7	0.043	0.203	0.019	0.137	0.058	0.234	NA	NA
region8	0.097	0.296	0.113	0.320	0.102	0.303	0.167	0.383
temp					9.351	5.126	7.189	4.141
photo					173.802	39.326	165.256	37.480

TABLE 5
DESCRIPTIVE STATISTIC 3

		All observations (n=2311)		1998 Survey (n=1273)	
Variable	**Description**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Q4_marriage	Dummy variable equal to 1 if baby is born in October, November, or December, 0 otherwise.	0.571	0.495	0.572	0.495
s_deduction	Potential tax deduction for spouse in 1000 yen as per the 2003 level	57.076	25.026	60.357	27.037
husband_age	Husband's age at the time of marriage	27.441	3.642	27.234	3.517
husband_educ	Husband's years in education	13.402	2.231	13.194	2.290
city_size1	Dummy Variable equal to 1 if the respondent lives in one of 14 major cities, 0 otherwize.	0.188	0.391	0.178	0.383
city_size2	Dummy Variable equal to 1 if the respondent lives in a city whose size is 100,000 population or more, 0	0.384	0.487	0.393	0.489
city_size3	Dummy Variable equal to 1 if the respondent lives in a city whose size is less than 100,000, 0 otherwize.	0.191	0.393	0.185	0.389
city_size4	Dummy Variable equal to 1 if the respondent lives in a villege, 0 otherwize.	0.237	0.425	0.244	0.429
region1	Dummy Variable equal to 1 if the respondent lives in Hokkaido, Aomori, Iwate, Miyagi, Akita, Yamagata or Fukushima, 0 otherwize.	0.104	0.305	0.101	0.301
region2	Dummy Variable equal to 1 if the respondent lives in Saitama, Chiba, Tokyo, Kanagawa, Ibaraki, Tochigi, Gunma, Yamanashi or Nagano, 0 otherwize.	0.326	0.469	0.315	0.465
region3	Dummy Variable equal to 1 if the respondent lives in Niigata, Toyama, Ishikawa, or Fukui, 0 otherwize.	0.050	0.217	0.046	0.210
region4	Dummy Variable equal to 1 if the respondent lives in Gifu, Shizuoka, Aichi, or Mie, 0 otherwize.	0.149	0.356	0.148	0.356
region5	Dummy Variable equal to 1 if the respondent lives in Shiga, Kyoto, Osaka, Hyogo, Nara or Wakayama, 0	0.172	0.377	0.184	0.387
region6	Dummy Variable equal to 1 if the respondent lives in Tottori, Shimane, Okayama, Hiroshima, or Yamaguchi, 0	0.065	0.246	0.061	0.240
region7	Dummy Variable equal to 1 if the respondent lives in Tokushima, Kagawa, Ehime, or Kochi, 0 otherwize.	0.037	0.188	0.040	0.196
region8	Dummy Variable equal to 1 if the respondent lives in Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima or Okinawa, 0 otherwize.	0.098	0.297	0.104	0.306
temp	Average monthly temperature at the time of marriage in prefecture j			10.109	5.029
photo	Average monthly photoperiod at the time of marriage in prefecture j			159.328	24.409

TABLE 6
DESCRIPTIVE STATISTIC 4

	All				1998 Survey			
	Wives Never Worked before (n=130)		Wives with Some Work Experience (n=2179)		Wives Never Worked before (n=63)		Wives with Some Work Experience (n=1210)	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Q4_marriage	0.577	0.496	0.570	0.495	0.571	0.499	0.572	0.495
s_deduction	65.517	28.392	56.548	24.724	68.970	31.835	59.908	26.703
husband_age	28.500	3.922	27.378	3.616	28.492	3.706	27.169	3.496
husband_educ	13.600	2.397	13.390	2.221	13.270	2.444	13.190	2.282
city_size1	0.246	0.432	0.184	0.388	0.317	0.469	0.171	0.377
city_size2	0.462	0.500	0.380	0.485	0.413	0.496	0.392	0.488
city_size3	0.162	0.369	0.193	0.395	0.143	0.353	0.188	0.391
city_size4	0.131	0.338	0.243	0.429	0.127	0.336	0.250	0.433
region1	0.108	0.311	0.103	0.304	0.079	0.272	0.102	0.302
region2	0.354	0.480	0.325	0.468	0.413	0.496	0.310	0.463
region3	0.015	0.124	0.052	0.222	0.016	0.126	0.048	0.214
region4	0.146	0.355	0.149	0.356	0.111	0.317	0.150	0.358
region5	0.285	0.453	0.165	0.371	0.286	0.455	0.179	0.383
region6	0.015	0.124	0.068	0.252	0.000	0.000	0.064	0.246
region7	0.015	0.124	0.038	0.191	0.016	0.126	0.041	0.199
region8	0.062	0.241	0.100	0.300	0.079	0.272	0.106	0.308
temp					11.211	4.963	10.051	5.028
photo					158.764	18.393	159.358	24.687

TABLE 7
ESTIMATION RESULTS (BENCHMARK MODEL)

	(1)	(2)
deduction	0.002	0.001
	(0.001)**	(0.001)
mother_age	-0.006	-0.007
	(0.004)	(0.005)
mother_educ	0.005	0.02
	(0.008)	(0.010)**
temp		-0.101
		(0.006)***
photo		-0.004
		(0.001)***
City Dummies	Yes	Yes
Regional Dummies	Yes	Yes
Observations	1623	842

Robust standard errors in parentheses
*, ** and *** significant at the 10%, 5% and 1% levels, respectively.

TABLE 8
ESTIMATION RESULTS (LATE CHILD BEARING MODEL)

	(1)	(2)	(3)	(4)	(5)	(6)
deduction	0.0001	0.0002			-0.007	-0.007
	(0.003)	(0.003)			(0.005)	(0.005)
childbearing34	-0.274		-0.278		-0.719	
	(0.190)		(0.083)***		(0.204)***	
childbearing29		-0.325		-0.313		-0.792
		(0.181)*		(0.097)***		(0.111)***
deduction*childbearing34	0.001		0.002		0.008	
	(0.003)		(0.001)**		(0.005)*	
deduction*childbearing29		0.002		0.001		0.008
		(0.003)		(0.001)*		(0.005)*
mother_age	-0.011	-0.016	-0.011	-0.016	-0.01	-0.02
	(0.004)**	(0.007)**	(0.004)**	(0.007)**	(0.006)*	(0.009)**
mother_educ	0.007	0.013	0.007	0.013	0.022	0.027
	(0.008)	(0.008)	(0.008)	(0.008)	(0.010)**	(0.011)**
temp					-0.101	-0.105
					(0.006)***	(0.007)***
photo					-0.004	-0.004
					(0.001)***	(0.001)***
City Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Regional Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1623	1349	1623	1349	842	723

Robust standard errors in parentheses
*, ** and *** significant at the 10%, 5% and 1% levels, respectively.
child_bearing29: Dummy variable equal to 1if mother_age is 29 or less, 0 if

TABLE 9
ESTIMATION RESULTS (BENCHMARK MODEL)

	(1)	(2)
s_deduction	0.0004	-0.001
	(0.0004)	(0.001)**
husband_age	-0.006	-0.011
	(0.003)**	(0.005)**
husband_educ	0.0001	0.013
	(0.005)	(0.008)*
temp		0.128
		(0.006)***
photo		-0.009
		(0.001)***
City Dummies	YES	YES
Regional Dummies	YES	YES
Observations	2311	1273

TABLE 10
ESTIMATION RESULTS (WIFE'S WORK EXPERIENCE MODEL)

	(1)	(2)
s_deduction	0.0003	-0.001
	(0.0004)	(0.001)*
never_worked	0.063	0.074
	(0.108)	(0.145)
s_deduction*never_worke	-0.001	-0.003
	(0.002)	(0.002)
husband_age	-0.006	-0.01
	(0.003)**	(0.005)**
husband_educ	-0.0001	0.012
	(0.005)	(0.008)*
temp		0.128
		(0.006)***
photo		-0.009
		(0.001)***
City Dummies	YES	YES
Regional Dummies	YES	YES
Observations	2309	1273

never_worked: Dummy variable equal to 1if wife never worked before, 0 otherwise