Taxing the Stork

Abstract - We examine the tax–deduction incentive for parents to have babies in December rather than January, focusing on whether or not parents get “shotgun married.” We choose this focus because non–shotgun–married parents are more likely than shotgun–married parents to time conception and, consequently, the birth of their children. Results show that in the 1976 forward sample, the tax deduction is positively correlated with December births among non–shotgun–married parents, who are likely to time conception for tax purposes, but not among shotgun–married parents. In other samples, the differential effect between shotgun– and non–shotgun–married parents, is consistent as predicted.

INTRODUCTION

Taxes are levied to encourage or discourage individuals from engaging in various activities; needless to say, these activities are not limited to those that are traditionally considered to be related to economics. A few studies have attempted to determine whether and to what extent taxes provide incentives to change human behavior, such as, the timing of human births, which is the subject of our paper. Several demographic studies show that some environmental factors, such as nutrition, temperature, and photoperiods, are related to the monthly distribution of births (see Lam and Miron (1996), and Bronson (1995, 2004)). Even if this is true, however, it does not imply that economic factors are unrelated to the pattern of human births. In fact, Dickert–Conlin and Chandra’s (1999) seminal study on taxes and birth timing uses data from the National Longitudinal Survey of Youth (NLSY) and discovers that tax–deduction benefits result in a surge in childbirth from the first week of January to the last week of December; this is due to the tax–deduction system in the U.S., according to which a child born on December 31 receives all the tax benefits in that year, whereas a child born one day later, in the next calendar and tax year, does not receive any tax benefits for the previous year. In addition, Gans and Leigh (2006) analyze the effect of a $3,000 “Baby Bonus” announced by the Australian government on May 11, 2004 for children born on or after July 1, 2004, to postpone the timing of births in Australia.¹

¹ Kopczuk and Slemrod (2003) investigate the temporal pattern of deaths around the time of changes in the estate tax system and find some evidence that there is a small death elasticity.
In this paper, we examine whether or not a tax deduction for dependents provides an incentive for the timing of births, using Japanese micro data from the 1998 and 2003 administrations of the “Nationwide Survey on Families” (in Japanese, Kazoku ni tsuiteno Zenkoku Chousa), conducted in January 1999 and January 2004.

One feature of our paper is that we focus on whether or not the parents get “shotgun married.” A shotgun marriage or a shotgun wedding is commonly understood as a rushed marriage or wedding because the bride is pregnant. The reason we focus on such parents is that parents who get shotgun married are presumably less likely to time conception and, consequently, the birth of their child; therefore, their pregnancies are less likely to be planned. On the other hand, parents who do not get shotgun married are more likely to time conception; thus, their pregnancies are more likely to be planned.

We incorporate the interaction term of tax–deduction benefits and shotgun status into our estimations, which enables us to examine our main hypothesis: parents who do not get shotgun married and stand to gain more in terms of higher tax–deduction benefits for dependents are more likely to have a baby in December than in January.

By breaking down the monthly distribution of births in our data based on whether or not parents are shotgun married, we can observe an important feature with regard to December births. Empirically, we consider marriages in which babies were born within six months or less after marriage as shotgun marriages and those in which babies were born twelve months or more after marriage as non–shotgun marriages (see the first subsection of the fourth section for details on our shotgun/non–shotgun classification). In Figure 1, the bottom line—depicting the difference between the share of babies born to non–shotgun–married parents and the share born to shotgun–married parents in each month—shows a large spike in December. In December, the share of babies born to non–shotgun–married parents is 3.4 percentage points higher than the share born to shotgun–married parents. This presents circumstantial evidence that a tax deduction for dependents or other socioeconomic factors provide non–shotgun–married parents with incentives to have babies in December rather than January. More precisely, it suggests that environmental factors, such as nutrition, temperature, photoperiods, and the number of holidays decreased the number of December births of children of both shotgun– and non–shotgun–married parents, which may cause a large dip in the number of babies born to shotgun–married parents in December (the dotted line of the top two lines). On the other hand, socioeconomic factors, such as a tax deduction for dependents, increased December births only of children of non–shotgun–married parents (the solid line), thereby countervailing the dip pertaining to shotgun–married parents.

Our paper contributes to the literature on the effect of tax on fertility in the following three ways: first, focusing on whether or not parents are shotgun married provides a different and interesting source of variation since we take account of the difference of the effect of tax deductions on the timing of births between shotgun–married parents and non–shotgun–married parents. In other words, the parameter of our interest is the average effect of tax policy on the timing of birth for parents who are likely to time conception, rather than the aver-

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2 We test the difference between group means for significance using t–statistics; there is a significant difference in births between non–shotgun–married and shotgun–married parents in March and December (the p–values are 0.048 and 0.001, respectively).
age effects of the tax policy on the timing of birth for all parents, regardless of type (shotgun–married or not). The latter is the parameter adopted by Dickert–Conlin and Chandra (1999). The difference between our paper and theirs is the fact that they do not attempt to identify which parents were more likely to time birth, while we do. The reason for this is that they focus on the timing of delivery by Caesarean section (C–section) and labor induction rather than the planning at the time of conception, nine to ten months prior to delivery. All parents have the option to time birth through a Caesarean section or labor induction around the time of delivery. On the other hand, we focus on the timing at the point of conception, which is an option available only to non–shotgun–married parents. Second, we can think of shotgun–married parents as being a control group. That is, since only non–shotgun–married parents have the tax incentive to time conception, they are treated as having a tax incentive for conceiving in time to get the tax benefit. However, both shotgun–married and non–shotgun–married parents are subject to noninstitutional and external factors (such as temperature, photoperiods, and the number of holidays). Finally, focusing on whether or not parents are shotgun married clarifies how much power they have over the timing of birth. The timing of birth may be affected not only by parents, but also by doctors and/or hos-

\[ \text{Notes: The figure depicts the percentage of all births resulting from a shotgun marriage (the first child was born 6 months or less after the first marriage), and the percentage of all those resulting from a non–shotgun–marriage (the first child was born 12 months or more after the first marriage), occurring in each month. Parents who had their first child 7 to 11 months after their first marriage are excluded.}
\]
\[ \text{Source: The data are from the 1998 and 2003 Nationwide Survey on Families and include 3,381 babies born to non–shotgun–married parents and 589 respondents; the children were born between 1964 and 2003.} \]
pitals. The preferences of doctors and/or hospitals affect the decision to manipulate the timing of delivery by Caesarean section and/or labor induction. However, we are interested in the effect of the above factors on the parents’ decision-making process rather than that of doctors and/or hospitals. Since both types of parents can manipulate the timing of delivery through medical intervention, we have to note that if the use of a medical intervention makes the timing of delivery differ between shotgun–married and non–shotgun–married parents by unobservable characteristics, then the estimates will be biased. However, as we will see in the next section, in Japan, these medical interventions do not have much impact on the timing of birth.

Our results show that in the case of the 1976 forward sample, a tax deduction is positively correlated with December births among non–shotgun–married parents, who are likely to time conception for tax purposes, but not among shotgun–married parents, who are unlikely to do so. That is, non–shotgun–married parents who stand to gain ten thousand yen in terms of higher tax–deduction benefits are 0.9 percentage points more likely to have a baby in December than in January. In the case of the full sample and the 1991 forward sample, the differential effect between shotgun–married and non–shotgun–married parents is consistent with non–shotgun–married parents reacting to tax incentives as predicted. That is, non–shotgun–married parents who stand to gain ten thousand yen in terms of higher tax–deduction benefits are only 0.6 and 1.5 percentage points less likely to have a baby in December than in January, while shotgun–married parents are 4.4 and 20.4 percentage points less likely to do so.

This paper is organized as follows. In the next section, we explain the controllability of the timing of birth and the personal income tax system in Japan. The third section describes the data source. The fourth section presents variable definitions and the calculation method. The fifth section describes the sample selection. The sixth section presents the estimation model and the estimation method. The seventh section presents the descriptive statistics. The eighth section presents our estimation results, and the final section concludes the paper.

THE TIMING OF BIRTH AND THE TAX DEDUCTION FOR DEPENDENTS

Controllability of the Timing of Birth by Shotgun– and Non–shotgun–Married Parents

The main assumption in this paper is that non–shotgun–married parents plan the timing of childbirth for tax purposes, while shotgun–married parents do not. In order to examine the validity of this assumption, we examine whether babies born to non–shotgun–married parents are more likely to be planned than others, based on the practice of obstetrics and gynecology and on cultural views in Japan.

First, several pieces of evidence point out the high costs and stigma associated with out–of–wedlock childbearing in Japan. According to the “International Attitude Survey on the Society with Fewer Children,” which was conducted in 2005 by the Cabinet Office (individuals between 20 and 49 years of age (child–bearing–aged adults) from Japan, Korea, the U.S., France, and Sweden were surveyed, resulting in 1,000 responses per country), 57.5 percent of the respondents in Japan have a negative opinion of having a baby out of wedlock, whereas only 43.1 percent of the respondents in the U.S., 8.3 percent of the respondents in France, and 4.0 percent of the respondents in Sweden have a negative opinion thereof. Also, according to the “Surveys on Japanese Life Values,” which have been conducted every five years since 1976 by the Japan Institute of Life Insur-
ance, about 60 percent of the respondents in each survey have a negative opinion of having children out of wedlock. With such high costs and stigma associated with out-of-wedlock childbearing, unmarried couples are reluctant to have children, and if they happen to have a child before marriage, then the child must not have been planned. Although, despite the stigma associated with out-of-wedlock childbearing, there have also been cases of women timing pregnancies to encourage their partners to marry them, it is natural to think that unmarried couples do not time childbirth for tax purposes. Hence, the high costs and stigma that come with out-of-wedlock childbearing are suggestive of a low probability of tax timing for shotgun-married parents. Consequently, we can translate the notion that babies born to shotgun-married parents are not planned into the notion that those parents randomly select the months in which their children are born. In order to examine the correlation between males getting married and wages, Ginther and Zavodny (2001) take advantage of this randomness of premarital conception and shotgun marriage by using the National Longitudinal Survey Young Men Cohort and the 1980 Census 5% Public Use Microdata Sample and find that both married men whose children were conceived prior to marriage and other married men earn significantly more than men who have never been married.3

Second, we present our arguments on the controllability of pregnancies and the predictability of deliveries. Firstly, more than 50 percent of couples get pregnant within a few months after deciding to have a baby. This is inferred from the fact that the reported annual cumulative pregnancy rate without the use of contraceptives ranges from 85 to 90 percent (Trussell, 1998; van Balen, Verdurmen, and Ketting, 1997); this implies that the monthly pregnancy rate is more than 20 percent. Even Bongaarts (1975) estimates from historical data that the average probability of conception per menstrual cycle ranges from 0.18 to 0.31. Next, we provide evidence on full-term babies in order to justify our definition of shotgun marriage, which is shown in the first subsection of the fourth section. A full-term baby is born 37 to 42 weeks after the last menstrual period, which occurs about two weeks prior to conception. In Japan, Statistics on Birth (SB; Shussou ni kansuru Toukei), which is a special report from the Vital Statistics, reports that only about five percent of deliveries are premature (before 36 weeks) and approximately one percent are postmature (after 43 weeks). Hence, we can conclude that more than 90 percent of deliveries are full-term, occurring approximately nine to ten months following conception.

Finally, we argue that the use of a C-section or labor induction at delivery, which enables even shotgun-married parents to advance the delivery date, might dampen our premise that shotgun-married parents are less likely to time birth than non-shotgun-married parents. However, we consider that these treatments are less important in Japan. With respect to Caesarean sections, such deliveries do occur, but are less prevalent in Japan than in the U.S. and Australia. According to the 2002 “Medical Facility Survey,” in Japan, 14.8 percent of deliveries are C-sections, while that figure is over 30 percent in the U.S. (Preliminary Births for 2005: Infant and Maternal Health (National Center

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3 Many Japanese also have a negative view of cohabitation, which may lead to shotgun-marriage and out-of-wedlock childbearing. According to the “Japanese National Fertility Survey,” which was conducted in 1992, 1997, and 2002 by the National Institute of Population and Social Security Research (responses were collected only from unmarried respondents), more than 65 percent of male respondents and more than 55 percent of female respondents stated that “any male and female living together should get married.”
for Health Statistics)) and Australia (Gans and Leigh, 2006). Moreover, according to the “Research on How Childbearing Should Be from Pregnant Womens’ Point of View,” which was conducted in 1999, only 12.3 percent (1,009 out of 8,217) of deliveries are C-sections in the randomly selected 276 university hospitals, general hospitals, maternity clinics, and midwifery centers throughout Japan (Watanabe and Shimada, 2000). With respect to labor inductions, the above-referenced research reports that only 10.6 percent (873 out of 8,217) of labors are induced. Hence, the use of labor inductions is less prevalent in Japan than in other countries; 19.2 percent of all births in the U.S. were the result of induced labor in 1998 (MacDorman, Mathews, Martin, and Malloy, 2002), and in England, labor is induced in one out of every five pregnancies carried to viability (Edozien, 1999). The percentage of the use of C-sections or labor inductions at delivery in Japan is half of that in the U.S.; however, we have to acknowledge that some of the control over timing could reflect these end-of-pregnancy decisions. Along with these treatments, manipulations in the registration of birth are used to stagger babies’ dates of birth. In the past, in Japan, most babies were delivered at home, which made it possible to manipulate the registration. However, for the period that we use in our analysis, most babies are delivered in a hospital rather than at home (the “Statistical Report on Mother’s Body Protection” shows that at-home deliveries stood at more than 80 percent in 1955, while they decreased by more than 60 percentage points from 1955 to 1965. They were almost absent in 1995, implying that it became difficult to manipulate the registration.

The Tax Deduction for Dependents

In this subsection, we explain the personal income tax system in Japan, which may provide incentives for the timing of births between December and January.

According to the personal income tax system in Japan, individual income earners are subject to a personal income tax. Couples file returns separately despite being married and, thus, do not have the option to file jointly, which could offer tax savings, particularly when spouses have different income levels and the average of their incomes could put them in a lower tax bracket, as in the U.S.

The annual amount of an individual’s personal income tax is computed on the basis of his/her annual income in a calendar year. The calculation is outlined as follows. First, some deductions or allowances may be made from the annual income, and what remains after these deductions and allowances is called the taxable income amount. Second, progressive tax rates apply to the taxable income amount. Finally, after deducting some tax credits from the amount computed above, the annual amount of personal income tax is obtained.

The deduction for dependents is what provides an incentive for timing conception so that the birth occurs between December and January: if a taxpayer has children or other relatives who depend on the taxpayer for their livelihood and whose income, if any, does not exceed 380 thousand yen (in 2003), then 380 thousand yen for each dependent is deductible from his/her annual income (on an average, the exchange rate in 1996 was 109.18 yen per dollar and in 2003 was 115.93 yen per dollar). Since whether or not a child qualifies as a dependent is based on the status on December 31, parents who have a baby on December 31 receive all of the tax-deduction benefits of having a baby in that year, whereas if they have a baby one day later—on January 1 of the following year—they receive no tax benefits for the previous year. Note that the amount of benefits a taxpayer can obtain is equal to
the product of the deductible amount and his/her tax rate.

The deductible amount for each dependent has differed from year to year (from 40 thousand yen in 1964 to 380 thousand yen in 2003). The tax rates and brackets of taxable income have also changed (from ten percent for taxable income not exceeding 3.3 million yen to 37 percent for taxable income exceeding 18 million yen in 2003). See Table 1 for the amounts and the marginal tax rates in Japan.

THE DATA

We use micro data from the 1998 and 2003 administrations of the “Nationwide Survey on Families.” The surveys were conducted in January 1999 and January 2004, respectively, and were provided by the National Family Research Committee of the Japan Society of Family Sociology and the Social Science Japan Data Archive, Information Center for Social Science Research on Japan, Institute of Social Science, University of Tokyo. In both surveys, a stratified multistage random sample from throughout Japan was surveyed, using the drop-off, pick-up method. In the 1998 survey, 10,500 individuals between 28 and 77 years of age as of December 1998 (born between 1921 and 1970) resulted in 6,985 responses (the response rate was 66.52 percent), while in the 2003 survey, 10,000 individuals in the same age group as of December 2003 (born between 1926 and 1975) resulted in 6,302 responses (the response rate is 63.02 percent). The individuals were not necessarily the head of the household.

Both surveys asked married respondents for the year and month of their latest date of marriage. The 1998 survey asked respondents for the year and month of the birth of their first through fifth child, and the 2003 survey, for that of their first child.

<table>
<thead>
<tr>
<th>Year</th>
<th>Deductions for Dependents</th>
<th>Minimum Marginal Tax Rate</th>
<th>Maximum Marginal Tax Rate</th>
<th>Number of Tax Brackets</th>
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<tr>
<td></td>
<td>nominal yen</td>
<td>2003 yen</td>
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<td></td>
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<td>8%</td>
<td>75%</td>
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<td>9%</td>
<td>75%</td>
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<td>37%</td>
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Note: * Indicates the period average.

4 The drop-off, pick-up method is conducted as follows. First, census takers visit randomly selected households and leave a hard copy of the questionnaire. Next the selected households respond to the questionnaire within a given time period, and then the census takers collect the completed questionnaires by visiting the households again at a convenient time.
through third child. The specific days of marriage and birth were not requested in either survey. The year and month of marriage and the year and month of the birth of the first child enable us to discern whether the respondents were shotgun married. However, we cannot judge whether the second or a subsequent child born to shotgun–married parents is the result of an unintentional pregnancy since almost all of the respondents were married at the time of their second child’s birth (4,948 out of 4,971, or 99.34 percent). Hence, in this paper, we analyze the timing of birth of only first–born children.

VARIABLE DEFINITIONS AND METHOD OF CALCULATION

“Shotgun Status”: non–shotgun

A shotgun marriage or a shotgun wedding is commonly understood as a rushed marriage or wedding because the bride is pregnant. As mentioned in the first subsection of the second section, a full–term baby is born 37 to 42 weeks following the last menstrual period. We take into account the possibility that non–shotgun–married women deliver within nine months after marriage due to conception during their honeymoon and/or due to premature delivery and that shotgun–married women deliver ten months after marriage due to postmature deliveries; thus, we consider marriages in which the first baby was born within six months or less after the first marriage as shotgun marriages and those in which the first baby was born 12 months or more after the first marriage as non–shotgun marriages.5 Needless to say, we exclude the respondents who delivered their first–born babies between seven and eleven months after their first marriage because they are neither shotgun nor non–shotgun. Hence, the variable non–shotgun is defined as a dummy variable that equals one if the first–born child was born twelve months or more after the respondent’s first marriage, and zero if the first–born child was born six months or less after the respondent’s first marriage.6

Father’s Annual Income at the Time of Birth of His First Child: father_income

We calculate father_income (the father’s annual income at the time of the birth of his first child, in 2003) using the father’s current income and working status because the survey asks about the father’s (and mother’s) income and occupation only at the time of the interview (we should note that Dickert–Conlin and Chandra (1999) are contemporaneous with respect to birth–timing decision). Hence, assuming that his occupation at the time of the birth of the child is the same as his current occupation, we calculate father_income using Wakabayashi’s (2001) method, which is based on King and Dicks–Mireaux (1982), Dicks–Mireaux and King (1984), and Hubbard (1985) (see the Appendix for details). The most concerning problem in estimating the father’s annual income at the time of the birth of his first child is the measurement error, rooted in the fact that our data is cross–sectional. We cannot know the individual–specific effect from cross–sectional data. The most widely used method of obtaining the unobservable individual–

5 By criterion (ii) in the next section, we confine our sample to respondents who have never been divorced or widowed. Hence, the latest marriage in our sample is the first marriage.

6 Akerlof, Yellen, and Katz (1996) regard marriages occurring within seven months prior to the birth of the baby as shotgun marriages. Ginther and Zavodny (2001) regard the situation in which birth occurs within seven months of marriage in the NLSY data and within two quarters in the Census data as a premartial conception that results in marriage. Kano (2006) regards a wedding that (i) is preceded by a pregnancy by up to six months or (ii) precedes pregnancy by up to six months as a shotgun wedding.
specific effect is the method we adopt here. King and Dicks–Mireaux (1982) and Dicks–Mireaux and King (1984) obtain the individual–specific effect by weighting the residuals and use the value of 0.5 with reference to the results with panel data such as those in Lillard and Weiss (1979) and Lillard (1977). We follow their method and value of weight.

With regard to the mother’s annual income, many women quit or change their jobs after giving birth, which leads to a larger measurement error in the mother’s income at the time of the birth of her first child. Hence, in our analysis, we do not use the mother’s annual income. In our data, the proportion of parents where the father’s annual income at the time of the interview is larger than that of the mother is 86.5 percent. Hence, since higher–income earners have higher tax brackets, we can presume that in the case of most parents, fathers claim their children as dependents.

**Tax–Deduction Benefits: deduction**

We calculate the tax–deduction benefits, deduction, using the variable father_income. We employ the following method. First, in each year, the report arbitrarily divides income into several brackets. In year 2003, there are 17 brackets; the minimum is less than 0.7 million yen and the maximum is more than or equal to 30 million yen. For each range of income, we convert father_income into per–capita average amounts of taxable income obtained from the National Tax Agency Annual Statistics Report (Kokuzei–cho Toukei Nenpou–sho), which was conducted by the National Tax Agency. Ideally, we would directly derive the amount using the personal income tax code in Japan. However, we are unable to do so since the surveys do not contain information pertaining to the amount of medical expenses and social or life insurance paid and the number of older dependents of respondents at the time of their children’s birth, which are required to determine the amount of other deductions or allowances. Note that, due to the lack of this information, everyone in the same income range in the same year has the same deduction. Second, the deduction amount for a dependent, which is obtained directly from the personal income tax code, is multiplied by the income tax rate corresponding to the average per–capita taxable income converted above, which represents the tax–deduction benefits at the time of the birth of the first child. Finally, we convert that amount to the 2003 yen value to obtain deduction.

**Example**

The National Tax Agency Annual Statistics Report for fiscal year 2003 states that if the total income of a taxpayer ranges between five million yen and six million yen, the average amount of taxable income is 3.48 million yen. The corresponding tax rate is 20 percent. Therefore, deduction is calculated to be 76 thousand yen (= 380 thousand yen × 20%).

**SAMPLE SELECTION**

We confine the sample to respondents (i) who have at least one child, (ii) who are married and have never been divorced nor widowed, (iii) whose husbands (or the respondents themselves, if they are male) are working, and (iv) whose babies were born after 1964. Moreover, we exclude all observations for which all the necessary information was not provided. Criteria (ii) and (iii) are due to the practical limitation that the surveys collect information on spouses and their year and month of marriage only for those respondents who are still married at the time of the interview. Since there is a strong possibility that shotgun–married parents who actually planned their marriage and pregnancy tend not to get divorced, unlike those who did not plan their mar-
riage and pregnancy, the divorce aspect of criterion (ii) might result in samples of shotgun–married couples appearing similar to those of non–shotgun–married couples who planned marriage and pregnancy. According to the Demographic Yearbook, the divorce rate in 2005 is 2.08 per one thousand people in Japan, while that in the U.S. is 3.60. On the other hand, the marriage aspect of criterion (ii) might not cause such a bias because single mothers and cohabitation unions with children are extremely rare in Japan. In fact, only five out of 11,151 respondents who have at least one child are unmarried in our survey (0.04 percent). According to the SB, only 1.93 percent of 1,123,610 births occurred out of wedlock in 2003. Moreover, according to the Population Census, the rate of single parenthood in Japan is 8.4 percent, which is much lower than that in the U.S., which is 28.1 percent. The low rate of single parenthood in Japan may be the result of a combination of few out–of–wedlock births and low divorce rates, which is due to the fact that normative sanctions and institutional penalties are strong compared to those in the U.S. and European countries. In addition, with respect to the cohabitation unions, the cohabitation experience itself is strongly associated with early marriage and marriage following pregnancy in Japan (Heuveline and Timberlake, 2004; Raymo and Ono, 2007). Criterion (iii) is required in order to calculate the father’s income at the time of the birth of the first child, \(father\text{\_}\text{income}\). Criterion (iv) is also required since these data are available from the Ministry of Health, Labour and Welfare’s “Basic Survey on Wage Structure,” which is used to convert the father’s current income to \(father\text{\_}\text{income}\), from 1964 onwards.

These restrictions reduce the number of observations from 13,287 to 5,463. Next, we restrict our sample to respondents who had their first child in December or January, which reduces the number of observations further to 984. Finally, we exclude 373 respondents because they do not fall into one of the two categories. Hence, the number of observations we finally use in our analysis is 611—comprising 68 shotgun–married respondents and 543 non–shotgun–married respondents. Note that this sample is larger than Dickert–Conlin and Chandra’s (1999) sample of exactly 170 partly because we use the entire months of December and January rather than one week in each. It is our larger sample size that allows us to distinguish shotgun–married parents from other respondents.

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7 We cannot completely exclude step families since the 1998 survey did not ask respondents whether their spouse had ever been divorced or widowed, while the 2003 survey did. Therefore, there is a possibility that some of the spouses had children from a previous marriage. However, we think the number of step families is negligible since in the 2003 survey, out of 4,713 respondents with one or more children who had never been divorced or widowed, the number of their spouses who had previously been divorced or widowed was only 123 (2.6 percent).

8 In the 1998 survey, restricting the sample to respondents who have at least one child reduces the number of observations from 6,985 to 5,906; restricting it to those who are married and have never been divorced or widowed reduces it to 5,043; restricting it to households in which the husband is working reduces it to 3,801; restricting it to households in which the children were born after 1964 reduces it 3,363; restricting it to respondents for whom all of the necessary information is available reduces it to 2,924; and restricting it to respondents whose first child was born in December or January reduces it further to 553. Similarly, in the 2003 survey, restricting the sample to respondents who have at least one child reduces it from 6,302 to 5,245; restricting it to respondents who are married and have never been divorced or widowed reduces it to 4,354; restricting it to households in which the husband is working reduces it to 3,165; restricting it to households in which the children were born after 1964 reduces it to 3,016; restricting it to respondents for whom all of the necessary information is available reduces it to 2,539; and restricting it to respondents whose first child was born in December or January reduces it further to 431.
ESTIMATION MODEL

In this section, we describe two estimation models. One is the benchmark model, which is similar to the model proposed by Dickert–Conlin and Chandra (1999), and the other is our main model, which considers whether or not the parents were shotgun married.

Benchmark Model

First, we use Dickert–Conlin and Chandra’s (1999) equation as a benchmark to discuss the effect of tax–deduction benefits on the timing of the birth of a first child without considering whether the parents were shotgun married. The decision to have a baby in December rather than January arises from an underlying difference in utility between the two choices. The first estimation equation we employ is

\[ \text{December}^* = \delta_0 + \delta_1 \text{deduction} + X \delta + \epsilon, \]

The dependent variable \( \text{December} \) is a binary choice variable that equals one if parents have their first child in December and zero if they have their first child in January.

We use the following explanatory variables concerning the determinants of having a first child in December rather than January. One of the most important explanatory variables is the tax–deduction benefit, \( \text{deduction} \). As discussed in the second subsection of the second section, the benefits provide the parents with an incentive to have a baby in December rather than January. Hence, we expect the coefficients of \( \text{deduction} \) to be positive (\( \delta > 0 \)).

We also include explanatory variable \( X \) to control for other factors that might affect the timing of birth between December and January. First, we have the explanatory variable \( \text{mother}_\text{age} \) (the age of the mother at the time of the birth of her first child). If old age is a cause of infertility, and late childbearing involves higher risks for mother and baby, it might be easier for younger mothers to time childbirth. Next, we include \( \text{father}_\text{income} \) to control the access for fertility treatment or artificial conception. We then include the variable \( \text{mother}_\text{educ} \) (mother’s level of education). If well–educated individuals have better knowledge of matters concerning tax and childbearing than those who are less educated, mothers with a higher level of education may be more likely to time childbirth. Next, we have a set of two variables, \( \text{mother}_\text{full–time} \) (a dummy variable for mothers who are full–time workers) and \( \text{mother}_\text{part–time} \) (a dummy variable for mothers who are part–time workers). The base category comprises mothers who are full–time housewives. If working mothers need to leave their workplace due to childbirth and child rearing, the timing is more important for the parents, especially for mothers who have job constraints. Finally, we include the variable \( \text{urban} \) (a dummy variable for parents who live in an urban area). The base category comprises parents who live in a town or a village. There may be many obstetricians and gynecologists in cities who provide medical means to time childbirths. However, we do not expect strong effects of these variables since we are looking at a short time horizon, i.e., a month. Although the first two variables are contemporaneous with the childbirth, the last four variables refer to the point in time when the survey is administered. However, including these four variables is reasonable since we assume there is little difference in the status represented by these variables at the time of delivery and at time the survey is administered. With respect to \( \text{mother}_\text{educ} \), most individuals had finished their education before the time of childbirth. With respect to \( \text{mother}_\text{full–time} \) and \( \text{mother}_\text{part–time} \),
full–time–working mothers are those who did not quit their jobs when their baby was born. According to the 2002 “Survey of the Children in the 21st Century,” which was conducted by the Ministry of Health, Labour and Welfare, the proportion of mothers who are working full–time six months after giving birth is 15.7 percent, which is about the same as the proportion of mothers who are working full time four and a half years after giving birth (15.9 percent). The survey also indicates that mothers who quit their job are less likely to find another full–time job. With respect to urban, it is known that residential mobility is lower in Japan than in other countries (see Long (1992)). According to the 2001 “Trails of Families in Post–War Japan,” which was conducted by the same survey administrator as the one we use, the average number of moves after marriage is 1.7, and of moves to other prefectures is 0.6.

**Shotgun Model**

Next, we add to the benchmark model the variable representing non–shotgun–married respondents, non–shotgun, and the interaction term deduction*non–shotgun.

\[ \text{December} = \delta_0 + \delta_1 \text{deduction} + \delta_2 \text{non–shotgun} + \delta_3 \text{deduction*non–shotgun} + X\delta + \epsilon, \]

\[ \text{December} = \begin{cases} 1 & \text{if December} > 0, \\ 0 & \text{otherwise.} \end{cases} \]

In this model, the coefficient of deduction, \( \delta_1 \), captures the average effect of tax policy on the timing of birth for shotgun–married parents, and the coefficient of deduction*non–shotgun, \( \delta_3 \), captures the differential average effect of tax policy on non–shotgun–married parents, who are likely to time conception and, consequently, birth. Thus, \( \delta_1 + \delta_3 \) represents the average effect of tax policy on the timing of birth for non–shotgun–married parents, who are likely to time conception. As presented in the introduction and in the first subsection of the second section, it is presumed that shotgun–married parents are less likely to time conception, whereas non–shotgun–married parents are more likely to do so. Hence, if non–shotgun–married parents are more likely to have babies in December than in January in order to benefit from the tax deduction for dependents, then \( \delta_1 + \delta_3 \) should be positive. In addition, if shotgun–married parents do not respond to the benefits, then \( \delta_1 \) should be insignificant. Both shotgun–married and non–shotgun–married parents are subject to noninstitutional and external factors such as temperature, photoperiods, and the number of holidays. The variable non–shotgun is included in order to capture the effect of factors other than the tax deduction for dependents and those that affect only non–shotgun–married parents. However, it is not shotgun–married parents, but rather non–shotgun–married parents who can time conception and, thus, we consider shotgun–married parents as the control group, and non–shotgun–married parents as the treatment group.

Similar to the benchmark model, we include the explanatory variable X in this model. We do this to control for factors that affect the timing of birth independent of the type of parents and, second, to control for observable differences in the groups that might influence birth timing. Typically, and as shown in the next section and in Table 2, individuals who are younger, less–educated, low–income earners, or rural dwellers tend to get shotgun married, which implies that X might be correlated with non–shotgun. Therefore, the coefficients relevant to non–shotgun are biased unless we include variable X. As
As mentioned in the fifth section, the shotgun–married parents are more likely to get divorced than non–shotgun–married parents. However, we cannot control the shotgun/non–shotgun status of divorced respondents since we have excluded respondents who have been divorced or widowed from criterion (ii).\(^9\)

In analyzing the benchmark and shotgun equations, we assume that \(\varepsilon (i = 1 \text{ and } 2)\) are normally distributed and, thus, we use a probit model with robust standard errors.

### DESCRIPTIVE STATISTICS

Figure 2 illustrates the monthly distribution of births compiled from the surveys used in our analysis and the Vital Statistics, which was conducted by the Ministry of Health, Labour and Welfare and is considered to be the most reliable report on the population of Japan. This report presents a graph representing 94,563,917 babies born between 1947 and 2004. We test the differences between group means for significance using \(t\)-sta-

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\(^\text{9}\) Even if we control the aforementioned variables, non–shotgun might be a proxy for an unobservable characteristic of non–shotgun–married parents, for example, foresightedness or altruism for their own children.
statistics, and there is no statistical difference between them except for February. Thus, our data are broadly consistent with the other large data sources.

We present descriptive statistics on the variables used in our analysis (see Table 2). First, let us consider the two columns on the left, which present 611 respondents and their children. The proportion of babies born to shotgun–married parents according to our surveys is lower than that observed in a larger sample: according to the SB, the proportion of babies born to shotgun–married parents in terms of all legitimate first–borns was 12.6 percent in 1980, 21.0 percent in 1990, and 26.3 percent in 2000. Since this is partly due to our strict categorization of shotgun status compared to that of the SB (in the SB, a shotgun marriage refers to a marriage in which parents have a child within approximately nine months of getting married, whereas, in our study, it refers to a marriage in which parents have a child six months or less after getting married), we can conclude that the difference between our figures and those obtained from the SB is not very large. In addition, the proportion of babies born to shotgun–married parents has been increasing over time both in the surveys we use and in the SB, as shown in Figure 3, suggesting that shotgun–married parents belong to younger cohorts compared to non–shotgun–married parents. The average duration from the time of marriage to the time of the birth of the first child is 2.54 years (or 30.4 months) for non–shotgun–married parents and –0.13 years (–1.5 months) for shotgun–married parents.

Figure 2. Monthly Distribution of Births

Note: The figure depicts the percentage of all births occurring in each month.
Source: The solid–line data are from the Vital Statistics, which includes 94,563,917 babies born between 1947 and 2004; the dotted–line data are from the 1998 and 2003 Nationwide Survey on Families, which includes 10,973 first–born children born between 1937 and 2003. Leap years are adjusted.
Other interesting patterns between shotgun–married and non–shotgun–married respondents are as follows. First, on an average, at the time of the birth of their first child non–shotgun–married mothers were approximately 3.4 years older than shotgun–married mothers. Second, non–shotgun–married mothers are slightly more educated than shotgun–married mothers (12.8 years vs. 12.5 years of education). Third, the average annual income of non–shotgun–married fathers at the time of the birth of their first child was about 9.5 percent higher than that of shotgun–married fathers (4.88 million yen vs. 4.41 million yen). Fourth, the proportion of non–shotgun–married parents who live in rural areas is lower than that of shotgun–married parents (19.2 percent vs. 23.5 percent). These socioeconomic characteristics of parents do not differ much even when we do not restrict our sample to respondents who had a child in December or January (see the two columns on the right in Table 2).

Finally, the average amount of tax–deduction benefits for dependents in our calculation is 94 thousand yen for non–shotgun–married parents and 88 thousand yen for shotgun–married parents, which is higher than the calculation in the example given in the second subsection of the fourth section. In Table 2 of Dickert–Conlin and Chandra (1999), the change in the tax liability associated with a December birth of the full sample is 400.52 dollars on average in 1996, whereas our corresponding figure is
797.54 dollars (92.5 thousand yen) in 2003. Moreover, the tax–deduction benefits of having a baby in December would have been 94.5 thousand yen for all January births, while those of actually having a baby in December are 92.5 thousand yen. There is no statistical difference between them.

ESTIMATION RESULTS

The estimation results of the benchmark model are shown in Table 3. There is no significant coefficient other than that of mother_age. The insignificant coefficients of deduction mean that tax–deduction benefits have no impact on the timing of birth. This result is not consistent with the results obtained by Dickert–Conlin and Chandra (1999). One possible reason for this inconsistency is the lower prevalence of C–sections and labor inductions in Japan than in the U.S. Also, the effects of these medical interventions become insignificant when the window is longer (i.e., a month rather than a week). Another possible reason is the measurement error of tax–deduction benefits, which might be due to the fact that our survey measured the benefits at the time the survey was administered, while Dickert–Conlin and Chandra (1999) did so at the time the decision to time the pregnancy was made.

On the other hand, considering whether or not parents get shotgun–married leads to different results. The estimation results of the shotgun model are presented in Table 4. The first three columns of the table present the results with (i) the full sample (1964 forward), (ii) the more–recent sample (1976 forward), and (iii) the most–recent sample (1991 forward), respectively. It is reasonable to pay attention to the most–recent sample (1991 forward) because the tax benefits for our full sample may be filled with measurement error. It is also reasonable to pay attention to the full sample because the sample size is large. There are more than 600 respondents in the full sample, while the 1991 forward sample comprises 172 respondents.

Our estimation results of the shotgun model are as follows. We find that the coefficients of deduction are negative and significant in columns (i) and (iii) and not significant in column (ii). Those of deduction*non–shotgun are positive and significant in all columns. The positive signs of these interaction terms are consistent with non–shotgun–married parents reacting to tax incentives as predicted. That is, in the case of the 1976 forward sample, non–shotgun–married parents who were more likely to time birth are

<table>
<thead>
<tr>
<th>TABLE 3</th>
<th>ESTIMATION RESULT (BENCHMARK MODEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deduction variable</td>
<td>December</td>
</tr>
<tr>
<td>deduction+</td>
<td>-0.009 (0.007)</td>
</tr>
<tr>
<td>mother_age</td>
<td>-0.012** (0.006)</td>
</tr>
<tr>
<td>mother_educ</td>
<td>0.016 (0.012)</td>
</tr>
<tr>
<td>mother_full–time</td>
<td>-0.020 (0.049)</td>
</tr>
<tr>
<td>mother_part–time</td>
<td>-0.034 (0.051)</td>
</tr>
<tr>
<td>father_income++</td>
<td>0.018 (0.013)</td>
</tr>
<tr>
<td>urban</td>
<td>0.004 (0.052)</td>
</tr>
</tbody>
</table>

Number of observations 611
Wald(7) 8.93
Prob.>Chi2 0.258
Log pseudo–likelihood -418.752
Pseudo R2 0.011

Source: Data from the 1998 and 2003 Nationwide Survey on Families.
Note: December is the dependent variable that equals one if the parents have their first child in December and zero if they have the child in January. The level of significance at 1% is ***, at 5%, is **, and at 10%, is *. Probit model is used. Marginal effects evaluated at the sample mean are reported. dF/dx is for discrete change of dummy variable from 0 to 1. + marginal effect of a ten–thousand–yen increase; ++ marginal effect of a million–yen increase.

10 We tried using the potential tax–deduction benefits in relative terms, which is calculated as the absolute amount divided by the father’s annual income at the time of the birth of his first child, i.e., father_income, but the coefficients of both deduction*non–shotgun and deduction in relative terms were not significant in any case.
more likely to respond to tax incentives. Our estimation results show that in this case, non-shotgun-married parents who stand to gain ten thousand yen in terms of higher tax-deduction benefits are $-3.8 + 4.7 = 0.9$ percentage points more likely to have a baby in December than in January. We test whether or not we can reject that $\delta_1 + \delta_3 = 0$. Wald statistics are 3.26 ($p$-value is 0.07) and, thus, we can reject it. If we assume that there are 94,579 December-born babies as recorded in the 2003 SB, and the proportion of babies born to non-shotgun-married parents to all first-borns is 73.7 percent, as mentioned in the 2003 Special Report of the SB, then babies born to non-shotgun-married parents increase by 627. Second, in the case of the full sample and the 1991 forward sample, non-shotgun-married parents who were more likely to time birth respond less negatively to tax incentives than shotgun-married parents who were less likely to time birth. That is, in the case of the full (1991 forward) sample, non-shotgun-married parents who stand to gain ten thousand yen in terms of higher tax-deduction benefits are only $4.4 - 3.8 = 0.6$ (20.4 – 18.9 = 1.5) percentage points less likely to have a baby in December than in January, while shotgun-married parents are $4.4$ (20.4) percentage points less likely to do so.11

Next, we present the results for the other explanatory variables. First, with respect to non-shotgun, the coefficient in column (iii) is negative and significant, suggesting that there is a factor other than tax-deduction benefits that provides the non-shotgun-married parents who had a baby after 1991 with an incentive to have a baby in December rather than January. Second, with respect to mother_age, we have negative and significant coefficients in columns (i) and (iii), as well as in the benchmark model in Table 3, which suggests that infertility due to increased

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11 Restricting the sample to 1976 forward and 1991 forward increases the $\chi^2$ values from 0.052 to 0.346 and 0.176, respectively, which means that the coefficients of most variables other than deduction*non-shotgun are not significant, and that the number of observations we employ in this analysis becomes smaller.
age is a bottleneck for mothers to time childbirth.\footnote{As we pointed out in the first subsection of the second section, in the past, in Japan, it was easier to manipulate a child’s date of birth at the time of registration. Hence, we conducted alternative estimations including the child’s birth cohort dummies. We also alternatively included the mother’s birth cohort dummies in order to capture the change in the mother’s attitude on timing birth according to different generations and temporal marriage–market conditions. However, almost all of the coefficients of these cohort dummy variables are not significant and none are of noteworthy significance.}

Finally, to include a broader time period, we replace the dependent variable with a binary choice variable, November–December, which equals one if the parents have a baby in November or December and zero if the parents have a baby in January or February. In column (iv) of Table 4, we obtain a similar result for the control variables; moreover we find that the coefficients of deduction*non–shotgun are not significant. These insignificant coefficients may imply that the timing of birth is adjustable within a limited span or that it is also affected by other factors.

CONCLUSION

In this paper, we examine whether tax–deduction benefits provide an incentive for timing birth, using micro data in Japan. A child born in December receives all the tax benefits that come with being born in that year, but a child that is born one month later—in the next calendar year—receives no tax benefits for the previous year. In fact, our data show significantly more December births if we break down births based on whether the parents were shotgun married. This suggests that there is a behavioral difference between shotgun–married and non–shotgun–married parents with respect to timing childbirth. That is, most children born to shotgun–married parents are presumably unplanned and, therefore, the parents were less likely to time conception and, consequently, birth, whereas many babies born to non–shotgun–married parents are planned and, therefore, the parents may have timed conception.

We conducted an econometric analysis taking into account whether parents do not get shotgun married and found that in the case of the 1976 forward sample, the tax deduction is positively correlated with December births among non–shotgun–married parents, who are likely to time conception for tax purposes, but not among shotgun–married parents, who are unlikely to do so. In the case of the full sample and the 1991 forward sample, the differential effect between shotgun– and non–shotgun–married parents is consistent with non–shotgun–married parents reacting to tax incentives as predicted. These results suggest that tax–deduction benefits play an important role in determining the timing of birth in the case of non–shotgun–married parents.

Finally, we present avenues for further research. First, Figure 1 shows that the monthly distribution of births in the case of shotgun–married parents fluctuates more than in the case of non–shotgun–married parents, although shotgun–married parents are believed to be less likely to time birth. This is most likely a consequence of the small size of the sample of shotgun–married parents; hence, the higher fluctuation with respect to shotgun–married parents may be smoother with a larger sample of shotgun–married parents. Furthermore, socioeconomic institutional factors such as tax deductions for dependents have been smoothing out the intrinsically fluctuating birth pattern. Second, looking at Figure 1, we can see another significant increase around April, which is the start of the school year and the fiscal year in Japan. It has been said that April may be a convenient time for parents to have
children since admission to nursery school (the Japanese equivalent to U.S. daycare) begins in April. Furthermore, parents who are altruistic with respect to their children may take into consideration the one-year advantage that April-born children have in the classroom over March-born children (see Kawaguchi (2006) for more details).

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REFERENCES

Bongaarts, John.
Bronson, Franklin H.
Bronson, Franklin H.
Dickert–Conlin, Stacy, and Amitabh Chandra.
Dicks–Mireaux, Louis D. L., and Mervyn A. King.
Edozien, Leroy C.
Gans, Joshua S., and Andrew Leigh.
Ginther, Donna K., and Madeline Zavodny.
Heuveline, Patrick, and Jeffrey M. Timberlake.

Hubbard, Robert G.

Kano, Shigeki.

Kawaguchi, Daiji.


Kopczuk, Wojciech, and Joel Slemrod.

Lam, David A., and Jeffrey A. Miron.

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MacDorman, Marian F., T. J. Mathews, Joyce A. Martin, and Michael H. Malloy.

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**APPENDIX**

**FATHER’S ANNUAL INCOME AT THE TIME OF THE BIRTH OF HIS FIRST CHILD: father_income**

We use Dicks–Mireaux and King’s (1984) method in order to estimate the father’s annual income at the time of the birth of his first child. We use the “Basic Survey on Wage Structure”
in order to interchange income between the 2003 level and the level in the first-born-child’s birth year to take into account inflation and the rise in wages. As we mentioned in the fifth section, we exclude the respondents who had babies before 1964 because the “Basic Survey on Wage Structure” is only available starting in 1964 and, thus, excluding them weakens the measurement error of deduction.

Salaried Workers

In Japan, the earnings of salaried workers are based on age, firm size, education, etc. Thus, we calculate salaried workers’ income at the time of their child’s birth as follows. First, we regress the logarithm of converted incomes on the dummy variables pertaining to age, firm size, educational background, and occupation.13 Second, we assume that one-half of the residual from this regression is an unobservable, individual-specific effect. Finally, we estimate the father’s income at the time of his first child’s birth by calculating the fitted value from the income equation with the age dummy at the birth of the child substituted for the actual age dummy, adding the unobservable, individual-specific effect and taking its exponential.

Self-Employed Workers

The earnings of self-employed workers are not based on seniority, unlike those of salaried workers. Thus, we calculate the self-employed-worker’s income at the birth of his child as follows. First, we calculate the difference between the current earnings of each self-employed worker and the average earnings of all self-employed workers. Thereafter, we add half of this difference to the average earnings of all self-employed workers in order to obtain each self-employed-worker’s income at the time of the birth of his first child.

13 We use 14 age groups (20–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74, 75–79, 80–84, and 85–89), 7 firm-size groups (fewer than nine employees, 10–99 employees, 100–299 employees, 300–499 employees, 500–999 employees, more than 1,000 employees, and government workers), seven educational-background groups (junior high school, high school, vocational school, junior college, university, graduate school, and medical college), and seven occupation groups (specialists/technical posts; managerial posts; office workers; shop workers; field workers; agriculture, forestry and fishing industry; and other occupations).