

# Labor Market Conditions and Fertility in Japan

Author: Zeyuan Chen  
Supervisor: Martin Dribe



## Abstract

This thesis aims to study the relation between fertility behavior and labor market in Japan. The slack youth employment market has been blamed for the continuously declining fertility rate. However, the linkage between labor market fluctuation and fertility behavior is empirically unclear. Based on the micro data compiled from Japanese Generally Social Survey, I apply discrete time hazard model and poisson regression. The empirical result shows that contemporaneous labor market fluctuation negatively impacts on the relative risk of first childbirth while has no significant influence on continuous births. However, the employment opportunities at labor market entry, which have continuous influence on sequent income, have little impact on women's total number of children. I also find that male and female unemployment affect female fertility in the same direction, though the strengths vary. Additionally, reactions of fertility behaviors are different across education backgrounds. E.g., when the unemployment rate increases, the relative risk of first childbirths for well-educated women diminishes more than that of low educated ones.

# Contents

|   |           |
|---|-----------|
| 1. Introduction.....  | 5         |
| 1.1 Background.....   | 5         |
| 1.2 Purpose and research questions.....   | 7         |
| 1.3 Method .....  | 7         |
| 1.4 Contribution .....  | 7         |
| 1.5 Disposition.....  | 8         |
| 2. Theory review and previous findings .....  | 8         |
| 2.1 Theory framework .....  | 8         |
| 2.2 Work and fertility in Japanese context.....   | 12        |
| <b>2.3 Women’s education and fertility .....</b>  | <b>15</b> |
| 2.4 Influence of parental family and place of upbringing.....   | 17        |
| 3. Methodology .....  | 19        |
| 3.1 Models.....   | 19        |
| 3.1.1 Fertility response to contemporaneous labor market condition:<br>Complementary log-log model..... | 19        |
| 3.1.2 Factors impacting total fertility .....   | 21        |
| 3.2 Data and sample.....  | 22        |
| 3.3 Variables.....  | 24        |
| 3.3.1 Dependent variables.....  | 24        |
| 3.3.2 Contextual variables .....  | 26        |
| 3.3.3 Individual level covariates.....  | 29        |
| 4. Childbirth and contemporary unemployment rate.....   | 32        |
| 4.1 First childbirths.....  | 33        |
| 4.2 Continuous childbirths .....  | 35        |
| 4.3 Discussion.....   | 35        |
| 5. Number of children and labor market entry .....  | 38        |
| 5.1 Results .....   | 39        |
| 5.2 Discussions .....   | 39        |
| 6. Impacts of social economic characters on total fertility .....                                       | 40        |
| 6.1 Education attainment .....  | 42        |
| 6.2 Family of origin and place of upbringing.....   | 42        |
| 7. Conclusion .....   | 45        |
| Reference.....  | 48        |

## Forward

Firstly, I would like to thank my supervisor Professor Martin Dribe, who gave me a lot of guidance and assistance in model building and data process. I appreciate for all his comments on my draft as well as advices on future academic development. Secondly, I want to thank my mum, Yuxia Zhou, who always stands behind me with endless love and supports my every decision. I am also grateful to Björn Wang, who raised many critics on my thesis and helped to improve it. The days with you are always peaceful and happy. I want to thank Weihua Shao. I am very lucky to have a friend like you, pulling me out of vacillation and encourage me to pursue ambition. I am thankful to Katt Chen, you are the sweetest roommate. Lastly, I would like to thank all my friends in Lund, your companies have make my life beautiful.

In the last few months, I entered a new research field, studied new theories, methods and a new econometric software. Luckily I have confirmed my interest in Demography. During the thesis writing I have seen myself improved. I am glad to use this thesis to finish my master study.

# 1. Introduction

## 1.1 Background

Over decades, the fertility rates of major industrialized countries have been decreasing. Today Japan is one of the nations with the lowest fertility. From 1970s, the total fertility rate stays below the replace rate 2.1, and declines to 1.34 in 2007 (National Institute of Population and Social Security Research). What factors give rise to the ever-declining fertility? Various theories have been developed to explain the falling fertility, among which the hypothesis of female labor market participation lie in the center. Cross-sectional studies (Brewster and Rindfuss 2000) imply that female labor market participation leads to lower fertility.

Work and fertility are the two central parts of women's live. As women have joined in labor force, fertility behavior and work may interact with each other. The negative association between them reflects the incompatibility roles as a mother and as a worker. With the increasing labor market participation, Japanese young women face growing risk from labor market fluctuations, which potentially alters women's fertility decisions. In Japan, unemployment rates surges during the prolonged economic depression in 1990s and early 2000. Fewer job opportunities and increased non-regular employments fall on youth. Non-employments and non-regular employments reduce youth's income and hinder Japanese young men from family formation, as they are expected to act as breadwinners. Thus, the macro shock ultimately increases unease in the society and alters female's fertility behavior.

The slack labor market has been blamed for the decline of fertility level in Japan. However, theoretically, low fertility rate is not necessarily associated with the deterioration of employment market. Female unemployment, which indicates income loss, on one hand reduces opportunity cost of fertility (substitution effect), while on the other hand reduces family budget for children-bearing (income effects) (Becker 1960,

1965). The response of fertility to worsening labor market depends on the interaction between the two effects. Some studies have documented a pro-cyclical pattern that nosedived working opportunities suppresses reproduction (Adsera 2005; Ahn and Mira 2002). Alternatively, substitution effect may surpass income effects and lead to a counter-cyclical pattern (Butz and Ward 1979). While the impact of female unemployment is ambiguous, male unemployment affects fertility mainly through income effects.

Labor market changes may alter the timing of childbirths as well as the total number of children a woman have. Transitory variation in employment opportunities may postpone marriages and childbirths, since people may prefer childbirth in the period with high income. Differently, permanent changes in labor market may have long term impact on fertility and eventually adjust the total fertility level. Different from other industrialized countries, in Japan, the labor market condition at the school-graduation year has continuous strong effect on later employment (Genda, Kondo and Ohta 2010). For this reason, getting employed during an economic depression may lead to long-term income loss, which results in fertility changes.

There are only a handful of empirical studies regarding the labor market and fertility in Japan. Most of them are based on macro data. In particular, how fertility reacts to the transitory fluctuation in employment opportunities are rarely touched. Higuchi (2001) discloses that people tend to delay marriage and childbirths when wage increases, although the correlation is not statistically significant. However, potential heterogeneity in fertility adjustments responding to labor market variations has not been discussed. Some other studies emphasize the influence of recession when job seekers enter the labor market. Hashimoto and Kondo (2012)'s study divides population by education backgrounds. They reveal that high unemployment rate in labor market entry results in later marriages and lower probability of having children for less educated women. Previous researches have shown that the timing of childbirths is affected by labor market conditions in the graduation year, but whether total fertility

is altered is still vague. My study aims to fill this research gap.

## 1.2 Purpose and research questions

This thesis intends to explore the relation between labor market fluctuation and fertility in Japan. I will study whether Japanese women adjust space of babies' conception to adapt transitory labor market changes. Different effects of changes in gender-specific labor market conditions are compared. Moreover, I aim to find out whether a slack labor market condition at female labor market entry has long-term impact on the total fertility level. The potential unequal responses of fertility to labor market changes are examined. At last, other influence factors on total fertility level, such as female education attainment and family of origin, are subsumed in my study.

## 1.3 Method

Based on the micro data compiled from Japanese General Social Survey (JGSS) 2000-2008 and yearly unemployment rates, this thesis focuses on Japanese women's fertility behaviors. To measure the influence of contemporaneous labor market condition on fertility, I utilize a discrete time hazard regression, with a sample of women between 20 and 49 years old from 1983 to 2008. Possion regressions are applied to check the influence of female unemployment rates in the school-graduation year on total fertility level. Women between 20 and 49 years old in survey years are included in the sample. I further break down the sample into less educated and high-educated to examine potential heterogeneity. Other socioeconomic factors are also studied in the Possion regression.

## 1.4 Contribution

By examining the connection between labor market and fertility, this thesis helps to explain the low fertility in Japan and shows whether falling fertility rates is a consequence of slack labor market. The contribution to current fertility and

employment literature is threefold. Firstly, I establish the dataset to study the causality effects of labor market shock on individual women's fertility behaviors. I also distinguish the effects of male and female employment market variation on female fertility. Secondly, relative long time period allows me to study both the transitory effects and the long-term effects. Thirdly, I compare the fertility response to labor market fluctuation across education backgrounds, which helps to understand the distinct fertility pattern related with education level.

## 1.5 Disposition

The rest of the thesis is organized as follows: The section 2 performs theory review and discusses previous findings. Model, data and variables are presented in section 3. Part 4-6 interpret and discuss the empirical results. The last part summarizes main findings and gives concluding remarks.

## 2. Theory review and previous findings

### 2.1 Theory framework

Foundation work regarding the linkage between employment and fertility is developed by Becker (1960, 1965). In his New Home economy theory microeconomic theory is applied to explain fertility behaviors. People are assumed to behave rationally. Children are seen as capital goods. Given budget constraints, parents make fertility decisions to maximize their utility function. The net cost of children is assumed to be positive. The costs contain not only direct costs such as money and time investments, but also opportunity cost. Benefits include labor from the adult children, security in the old ages and social recognition brought by parenthood. However, why fertility rate have decreased in western countries when economy steams up is unclear, since costs and incomes increase simultaneously. One possible answer refers to the value of time. Mother's time is a major part in children rearing. Rising human capital accumulation from education and work augments women's time value, which makes children more

costly. Although this paper mainly focuses on the former changes, another explanation concerning quality-quantity trade-off also worth mentioning. Naturally the expectation for children is greater in higher economic strata. Family size has to be limited to cultivate desired children. Therefore, greater earning power leads to higher cost of children and then reduce the demand of children.

Women's increasing economic independent, which is stemming from better work opportunities and education, lies in the center of low fertility. At individual level, fertility is negatively correlated to female work activities. Women who participate in economical productive work have fewer children than those do not, on average, since they spend less time on children. The negative link exhibits the incompatibility between childbearing and working duties for women.

Some literature has revealed the mechanism behind the negative role of labor market participation on procreation. Labor force participation prohibits fertility by postponing marriage and childbirth. Increasing age a women transit into motherhood results in a lower total fertility (Kohler, Billari and Ortega 2002). Retherford et al. (2001) discover that Japanese women with higher education attainment and paid work tend to be against the domestic-role, and bring about delay of transition to parenthood. Moreover, postponed marriage and less childbirths may be a consequence of higher opportunities cost among women with greater human capital, or a result from the increasing time women spend on accumulating their own human capital, such as work and education (Brewster and Rindfuss 2000). In Japan, the ratio of women to men wages has rising from 0.71 in 1979 to 0.89 in 1999 (Retherford et al. 2001). The increasing wages increase the opportunity cost of having children.

As larger proportion of women participate in economical productive work, changes in wages may have impacts on fertility behaviors. Berker (1960, 1965) classifies influences of a decrease in a woman's wage into income effects and substitution effects. Reduced wages (unemployment) increase the relative cost of

children and thereby lower the fertility (income effects). On the other hand, a drop in a woman's income lessens the value of time and the opportunity cost of childbirth. Hence, it raises the demand of children (substitution effects). The overall effect of change in women's income depends on the relationship between market wages and profitability of home production. In other words, because the relative strength of a single effect is uncertain, the net result of changes in women's wages during an economic depression or expansion may be asymmetric.

Some studies (e.g., (Adsera 2005; Ahn and Mira 2002; Butz and Ward 1979; Dehejia and Lleras-Muney 2004)) have exhibited that varying macro-level economic condition could influence the timing of childbirths and total fertility level. Macroeconomic indicators points to the living environment of individuals, as well as the economic well-being of the whole society. During a recession or stagnation, people are more likely to loss work or face wage decreases. Even though only small portion of people actually become unemployed, depressed economy gives workers sense of economic insecurity. Hence, high unemployment tends to lower fertility rate (Adsera 2005; Ahn and Mira 2002).

The interaction between substitution effects and income effects, however, may result in an opposite result. By modeling and testing the influence of macro labor market fluctuations on fertility rate, Butz and Ward (1979) reveal a counter-cyclical link in the U.S. Working women is more likely to give birth when their earning are relative low in a economic downturn, since substitution effects of women's earnings surpass income effects of family income.

Since reproduction is decided by both parents, the fluctuation in male wages should also be counted. While the net prediction of reduction in a woman's wage is ambiguous, a wage loss on other family members (husband) has only income effects, since it does not change women's time value. Dribe and Stanfors (2009) find that Swedish men enter parenthood in younger age when job vacancies increase. Swedish is

a rather gender equal country. In a society where men's breadwinner role is more prevalence, such as Japan, it could be expected that male wages changes may have stronger income effects.

As men are less engaged in childrearing, men's working life have less conflicts with their family. In individual level, a man's career may affect on fertility behaviors from two different means (Zedeck 1992). One is spillover effect, which indicates success in career leads to success in family. Especially in a gender-egalitarian division society, success in labor market assists a man's bread-winner role. The other is called compensatory effects, which assumes life goals in jobs and fertility is substitutable. When the formal social inclusion weakens, one may resort to family life. Moreover, the relationship between working life and family may be no-linear. While compensatory effects are stronger among low-income person, spillover-effect dominants high-income men. Tölke and Diewald (2003) reveal that men put off their first childbirth under employment insecurity. In contrast, stepping up in career encourages childbirth in West Germany.

A dynamic model of fertility may help to understand the influence of income fluctuation. The situation in employment may alter the time of births and the total fertility level. Influence of permanent income changes and transitory income changes should be distinguished. If the capital market is perfect and credit constrained does not exist, people may adjust the space of childbirths (timing) to smooth life time consumption to temporary income changes, while the total number of children stays the same. E.g., Kondo (2011) finds that in the U.S marriages and childbirths are not affected by the poorer employment environment experienced in youth in the long term. Alternatively, permanent income changes may lower the completed fertility. This hypothesis is support by Huttunen (2012)'s study in Finland.

The impact of labor market fluctuation (income loss) may differ across social groups. Perry (2004) suggests that the income effects is stronger for high income

persons and substitution effects prevail among low income persons. She observes a pattern in the U.S. that high-income earners reduce fertility and low-wages women increase childbirths during an economic recession. An empirical study in Spain supports Perry's argument (Ahn and Mira 2002). They report that further increase in wage for Spanish women who earn sufficient high wages may enhance childbirth, since income effects exceeds substitution effects. Dehejia and Lleras-Muney (2004) look into the connection between unemployment rate and the time of conceptions and find different response and education groups. Precisely, Whites, low-education women are more likely to have babies' conception in economic downturn since the substitution effects is stronger among them than among high-educated women.

## 2.2 Work and fertility in Japanese context

Japanese labor market is in favor of life-time employment which starts after graduation and ends with mandatory retirement. Since the work practice prefers continuous work, women who leave their job temporarily face high opportunity cost. Hence, women have to select either continue to work and delay marriages and childbirth, or to lose their jobs and focus on family.

During the economy expansion, women may return to workforce easier after their children start schooling. During an economic downturn there are less work opportunities. Gutiérrez-Domènech (2008) suggests that potential mother caring both their current job and employment after childbirth. Thus, dropping out from a good work position for family becomes increased costly for Japanese women. Alternatively, recession may have positive effect on fertility. Employers who have financial difficulties may more or less encourage workers to quit. Moreover, the difficulties in job searching may push young women to giving up working and enter marriages. Nevertheless, inter-temporal substitution in Japan is difficult. Kondo (2011) argues that counter-cyclic correlation between labor market condition and fertility in the U.S could be attributed to high labor turnover rate. Mothers in the U.S could relative easier to

re-entry labor market after childbirths. Japanese mothers may find it more difficult because of rigid labor market structure. Therefore, Japanese women are likely to put off marriages and childbirths in economic depression.

Gender-gap in work place and family should also be discussed. In the last 20 years, masculinity hegemony in Japan has been challenged to some extent while still dominant the society (Hidaka 2010). Women still have to financially depend on family due to the discrimination in the employment opportunity and salary. On the other hand, social norm expects man to be the breadwinner and support his family economically. As discussed above, Japanese youth are placed in a disadvantage position due to the institution in labour market during the prolonged recession. Less regular work opportunities leads to potential income loss for young men. What's worse, the idea of female status hypergamy (male status hypogamy) dominates the marriage market (Fuwa 2004). The deterioration in youth employment erodes young men's ability to enter marriage and rear children. In Japan, non-marry children is still rare. Hence, late marriage directly results in late childbirth. To sum up, I hypothesize that:

(H1) Labor market condition (both male and female unemployment rates) influences contemporaneous hazard of childbirths.

The work institution in Japan places youth in disadvantage position in economic recession, which may prohibit youth's family formation and childbirths. The proportion of non-regular employment rises among Japanese youth, since employers now hire more non-regular workers than before (Statistic Bureau). To understand this trend, two special features of Japanese labor market need mentioning: school-based hiring system and restricted dismissal law. Japanese labor law involves junior school and high school in the job hunting process of their senior students. Schools have responsibility to mediate employers and graduates students. Once graduate students are hired as regular workers, the law in Japan prohibits employers from dismissing them. At the same time, schools take an essential role in regular work market. Due to the

separation between job market for graduate students and mid-term worker, if students fail to get regular hired in a recession at graduation, they will be in a continuous disadvantage position in their later life. Even if the economy recovers, companies will prefer new graduates who are vouched by schools.

The legal or institutional protection in labor market brings extra burden for those not under umbrella. Dismissing regular workers for economic aim is proscribed by the socio-cultural attitudes. Hence, employers tend to lay non-regular workers off during a recession. Furthermore, companies reduce new hiring opportunities instead of terminating incumbent workers. During the prolonged economic recession in 1990s and early 2000, youth who transit from schools to work paid the main cost for the slack in labor market (Genda 2001).

Because of the rigid labor market in Japan, fail in labor market entry may influence one's employment in the long-term. Genda et al. (2010) find that one percent increase in unemployment rate in initial results in 3%-4% drop in possibility of being hired over the next 12 years. They show that the negative impact chiefly works through lowering the likelihood of regular full-time employment. Non-regular employment and unemployment in the long term lead to life income loss as well as decrease in human-capital accumulation (Adsera 2005). The later consequence results in increased probability of unemployment and low wages in the future, especially when the unemployment occurs in early career stage. Since initial labor market has continuous impacts on sequent income, it may alter the total number of children a woman has. Moreover, Higuchi (2001) finds that bad labor market at graduation speed up marriages which may impact on total fertility as well. Hence, I have the following hypothesis:

(H2) Labor market conditions experienced at labor market entry influence women's total fertility.

Deterioration in employment opportunities may influence differently across groups. Less-educated (junior and high school graduates) are easier shocked by slack labor market. Employment market for them is strictly regulated at graduation time, because of the school-based hiring system. The situation for colleges students is comparatively better; at least they could contact employers without the mediation of schools. Moreover, non-regular employments are more common for less-educated women than high-educated women. Hence, less-educated persons have higher risks of job losses under high unemployment rates. The different response to economic shocks may lead to distinct changes in fertility behavior. In fact, as discussed above, the substitute and income effects stemming from female wages fluctuations vary among different groups. Hashimoto and Kondo (2012)' reveal that high unemployment rate in labor market entry results in later marriages and low probability of having children for less educated women, while lead to increased fertility among well-educated women. They believe that substitution effects are stronger for well-educated women and income effects dominant for less-educated women. At the same time, different attitude towards work may also result in various reactions. For example, high-educated women may care more about career and reduce fertility when they are unemployed (Huttunen 2012). It could be hypothesized that

(H3) The influence of labor market changes on fertility vary among less educated and highly educated groups.

### **2.3 Women's education and fertility**

Extensive studies have reported the negative linkage between women' education attainment and fertility (e.g., (Becker 1973; Blossfeld and Huinink 1991)). Theoretically there are two explanations for their correlation. Firstly, accumulation of human capital from increasing education encourages labour force participation and thereby leads to delay in family formation (Becker 1973). Secondly, education expansion postpones women's timing of marriage. Normally women who are

participating in schools or trainings are not expected to married. In Japan, higher education is not viewed as public goods. University students have to heavily depend on their parents economically. Completing schools and becoming economically independent of parents are considered as an important signal of adult status (Oppenheimer 1988). Thus youth are not at the risk of marriage until their educations are completed. What is more, the opportunity cost of dropping out rise significantly for women since education becomes more important in contemporary situation (ibid.). The conflicting role as student and as mother delays marriage and first birth. This hypothesis has been proven in many countries. For example, Dribe and Stanfors (2009) find that higher education attainment delays the first birth in Sweden.

High education attainment's negative impact does not limit to delay the transition to motherhood. It also lowers the total fertility in the older ages. More educated women are more likely to be career-oriented and obtain good job opportunities. Meanwhile, education may change their attitude towards family and reproduction. Furthermore, it might be a self-selection process. Those who are less family-orientated choose to stay at school longer. Blackburn et al. (1993) empirically show that the rising later childbirths and childless could be attributed to greater human capital investment.

Empirical study on Japan has confirmed the theory above: that higher educated women indeed marry and have their first child later than less educated ones (Retherford et al. 2001). However, it is not the whole story. Japan today is still one of the most gender inegalitarian countries in industrialized world (Fuwa 2004). The preference of female status hypergamy or male status hypogamy persists among the marriage market. Raymo and Iwasawa (2005) argue that continuous economical dependent on men and the decrease in supply of highly educated men afford reasons for the raising of late marriage and non-marry for high educated women in Japan. In other words, improved economic resource relative to men and stubborn gender role hinder well-educated women from mating. Delayed marriage naturally leads to postponed procreation and lower fertility level. Hence, the following hypothesis is

proposed:

(H4) Education attainment is negatively related to the total fertility.

## 2.4 Influence of parental family and place of upbringing

Characters of family background include social status of origin family, number of siblings and size of municipality at age 15, etc. Several studies have found that the number of siblings is positively related to women's childbirths (e.g., (Blackburn et al. 1993; Dribe and Stanfors 2009; Rijken and Liefbroer 2009; Tölke and Diewald 2003)). The correlation of fertility pattern of parents and children is usually attributed to socialization-related mechanism (e.g., (Murphy 1999; Murphy and Wang 2001)). Having more siblings show parents' stronger family orientation, and provides a person more experience of closeness. It is assumed that the preference towards family is transmitted to children and thereby results in positive relationship across successive generations. Moreover, larger family with more siblings usually indicates greater kinship support, which may make childbearing easier (Murphy and Wang 2001). More siblings also suggests less resource allocated to each children and relative disadvantage in education. At the same time, having several siblings may lead to the intendance for early marriage to win the competition of producing grandchildren. However, the inter-generational influence may also be negative. Easterlin (1969) argues that people grow up in smaller families may have economic advantage over their counterparts in large families, due to less peer competition within the family. It is assumed that people's materials aspirations are determined before adulthood. Hence, better actual environment encourage them to produce a bigger family, which is negative related to fertility pattern of their parents. Easterlin's Hypothesis seems not empirically prevalence. But some researches do report that there is no or negative effects of parents' procreation behavior (Murphy 1999). Based on the mechanisms described above, the propensity and behaviors of parents are expected to pass to children. I hypothesize that:

(H5a) The more siblings a woman has, the more children she has.

Besides parents' reproduction behaviors, the social context of parental family is also expected to influence procreation pattern. Social status of origin family, especially financial resource, indicates social opportunities available to a respondent. Especially in Japan, higher education is not viewed as public goods. Parents have to pay the expensive cost for public school, as well as fees to private institutions to assist students in their examinations. Financial resource may directly determine the quality and quantity of education a respondent could receive. Thus financial resource may indirectly affect fertility through the negative impacts of education. According to Easterlin' hypothesis (Easterlin 1969), fertility is negatively related to one's consumption aspiration which is assumed to be developed during her upbringing. Thus, parents' income, which is seen as an indicator for children's material aspiration, discourages children's fertility. Thornton (1980) provides evidence to support the negative linkage. On the other hand, financial resource in parental family and fertility are positive correlated. Parents' wealth could provide more financial support to the young adults. Since the direction of influence is unclear, I would rather concern whether the influence exist and thus raise the following hypothesis:

(H5b) The financial resource of parental family has an impact on one's number of children, either positively or negatively.

Social context of parental family may impact the children's family value. The social class and culture group the parental family belonging to shape children's attitude towards family and fertility. When parents are well educated and mother participates in labour market, children naturally receive more knowledge about employment. They are more likely to pursue a career when they grow up, compared to those who are fostered by non-employed mothers. Moreover, social status of family suggests a person's normative expectation to keep the social status of original family. Hence, I assume that:

(H5c) Women who have employed mothers have less number of Children.

Last but not least, place of upbringing is expected to influence childbirths as well. For example, Blossfeld and Huinink (1991) show that women from rural regions transit to motherhood earlier than their counterparts from urban area in West Germany. Dribe and Stanfors (2009) find a similar pattern in Sweden. The same phenomenon is assumed to exist in Japan.

(H6) Women grow up in urban have fewer children than those in rural area.

### 3. Methodology

This thesis will use quantitative analysis. Quantitative research is used to identify general pattern and relationship, test theories and make predictions. Although some people might criticize quantitative research that it fails to distinguish people and hinder the connection between research and everyday life (Bryman 2004), it enjoys the advantage of generality which is difference from qualitative research. Since my aim is to test the general relationship between fertility changes and labor market condition, quantitative method and its deductive nature fit my purpose well. In the following section, I will first discuss the models. Then data and sample selection are presented. The last sub-section provides variables.

#### 3.1 Models

##### 3.1.1 Fertility response to contemporaneous labor market condition: Complementary log-log model

To measure the influence of contemporaneous labor market condition on fertility, I resort to hazard regression. It is now common in the studies of person history event that constant factors and time-varying covariates are modeled simultaneously. Moreover, it allows the person to be censored some time before the subject events

actually happen. In this thesis, births are the main focus. I examine first births and continuous births separately. Concerning first births, women are censored since they are 20 and followed until they transit to motherhood. Women's ages take part in the regression as time-varying covariates. Other individual level factors, such as education, characters of parental family, and labor market condition at school-graduate year are also included as constant variables. Contextual covariates are yearly-biased unemployment rates. Furthermore, in order to examine influence of labor market across different education background, the regressions are performed separately for less educated and well educated population.

A Complementary log-log discrete-time survival model is employed here. The Complementary log-log model (cloglog) is an alternative linear model to the logit model (Rabe-Hesketh and Skrondal 2008). For a continuous Cumulative Distribution Function  $\Phi$ , cloglog takes the general form:

$$h_{it} = \Phi(\alpha + \beta'X) \quad (1)$$

where  $h_{it}$  is the hazard for the event occurring at time  $t$  for person  $i$ . Similar to the logit transformation, the cloglog model transforms a response restricted to the interval  $[0, 1]$  into the interval  $(-\infty, +\infty)$ . The selected covariates  $X$  are supposed to be able to explain the changing possibility of the event occurring. Specifically, the cloglog discrete-time model used in this thesis takes the transformation:

$$\log\{-\log[1 - y_{it}]\} = \beta_0 UMP_{t-1} + \beta_1 Z_t + \beta'X \quad (2)$$

where  $y_{it}$  is the dichotomous indicator for giving birth to a child at time  $t$  for woman  $i$ .  $UMP_{t-1}$  is the yearly unemployment rate at time  $t-1$  with corresponding coefficient  $\beta_0$ .  $Z_t$  is a categorized variable marking the woman's age group at time  $t$ .  $X$  is a vector of all the other control variables that are time-constant.  $\beta$  is the coefficient vector. The model can also be written as the following:

$$y_{it} = 1 - \exp\{-\exp[\beta_0 UMP_{t-1} + \beta_1 Z_t + \beta'X]\} \quad (3)$$

The exponentiated regression coefficient can be interpreted as the hazard ratio for

one unit change in the corresponding independent variable, controlling for the other covariates. A factor's hazard ratio is the factor's relative risk brought to the hazard  $h_{it}$ . The cloglog model is estimated using the method of maximum likelihood. To test the significance of the regression parameters, Wald test is utilized. The Wald statistic for testing the null hypothesis, that all coefficients jointly equals zero, follows an asymptotic  $\chi^2$  distribution, with the number of restrictions imposed as degrees of freedom.

### 3.1.2 Factors impacting total fertility

In order to explore the possible factors which determine the total number of children, Poisson regression is used. While the cloglog regression mainly emphasizes on the temporary effect of fluctuation in labor market, Poisson regression aims in revealing whether the condition at labor market entry has a long-term influence on a women's childbirths. The most probable distribution of the variable, the count number of children, is Poisson distribution, which expresses the possibility of a given number of events taking place in a fixed period of time. Let  $Y$  representing the total number of children. By assuming Poisson distribution of  $Y$ , I assume that the conditional variance equals conditional mean. It is a fairly strong assumption, but at the same time greatly simplifies calculations. Poisson regression also assumes the logarithm of expected  $Y$  given the independent variables  $X$  can be modelled by a linear combination of independent variables (Rabe-Hesketh and Skrondal 2008).

Poisson regression can be written as:

$$\log(E(Y|X)) = \alpha + \beta'X \quad (4)$$

Where  $Y$  is the response variable,  $X$  is a vector of independent variables,  $\alpha$  is the constant and  $\beta$  is the coefficient vector which indicates the explain power of the individual variables. In my thesis,  $Y$  refers to total number of children a woman have until the survey year. The vector  $X$  includes female unemployment in school-graduation year, education attainment and social status of family of origin. In

particular, with a focus on effects of labor market at graduation year across different education background, the regressions are performed separated for less educated and well educated population. The model can be estimated by the method of maximum likelihood. Wald test is utilized to test the significance of the regression parameters. All the regressions are run in Stata (code: `possion` and `cloglog`).

### 3.2 Data and sample

The individual level data is drawn from Japanese General Social Survey (JGSS) (Tanioka 2000-2003, 2005, 2006, 2008). JGSS is designed and performed by the JGSS research center at Osaka University of Commerce, which is official certified by the Minister of Education, Culture, Sports, Science and Technology as a Joint Usage/Research Center in October 2008. The first regular survey of JGSS project was launched in 2000. Aiming in studying the attitude and behaviors in contemporary Japan, the topics of JGSS covers wide-ranging genres, such as employment and financial situation, family structure, leisure activities, etc. Since it is highly similar to the original GSS in the U.S which has been conducted by many countries with similar vision, it makes international comparison possible. Until 2010 there have been 8 waves of surveys and collected information from more than 30,000 respondents. It also establishes a large scale dataset consisting over 2000 variables. The targets contain women and men from age 20 to 89 living in Japan as of September 1<sup>st</sup> in each specially survey year. It is sampled by stratified 2-stage sampling method based on census divisions of regional blocks and population size. Interviews and self-administered questionnaires are combined to obtain the maximum effects. Although the survey is carried out only in Japanese, the dataset is available in both Japanese and English.

This thesis uses JGSS data collected in 2000, 2001, 2002, 2005, 2006 and 2008. Like other datasets, researchers have to compromise between desired research questions according to the theory and what the data allows them to do in practice. Compared to other available Japanese data source, JGSS is advantaged with its relative

large scale and diverse topics. Down to my study, JGSS data provides the respondents' fertility history, personal information and background of parents. On the other hand, it also has some limitations. Marriages history is only included in the questionnaire in 3 waves. Since the time of first marriage is unknown, I set age 20 as the start year of being at risk of childbirths. JGSS doesn't provide information about employment history either. Hence it is unclear whether a respondent has ever worked before her conception. In addition, all the time variables are precise to year. Hence, I will use yearly basis in the following analysis.

To study the female fertility, I restrict the sample to 20-49 years old Japanese women. Moreover, I presume people currently involved in schooling or training are not at the risk of marriages or fertility. Thus women who haven't completed school are dropped out. In this thesis, only conceptions leading to a live birth are in interest.

Unemployment rate is viewed as an indicator of labor market condition. Yearly-base of unemployment series are obtained from Labor Force Survey (Statistic Bureau). State-level unemployment rate and female unemployment rate is available from 1953, while regional level data starts from 1983. Since both unemployment rate at labor market entry and contemporaneous unemployment rate are needed, I decide to apply state-level unemployment rate.

Three different sub-samples are constructed to estimate the models discussed above. For the two models using birth event as dependent variables, person-year series are established based on the fertility history recorded in JGSS. Yearly unemployment rates are merged into person-year series of childbirth history. As the person-year series are established upon the survey, potential information loss needs to be considered. Normally, people's memory tends to become incorrect if an event happened long from now. E.g., a respondent at age 80 in 2008 may provide erroneous information about her childbirth in 1960s which is too far from the survey year. I set the start point of my study period at 1983. Hence, only babies' conception occurred in the past 25 years are

counted. The period restraint helps to ensure the reliability of data. The period I study here is from 1983 to 2003.

In the study of first child births, women are assumed to be at risk from age 20 to 49. Each childless woman will be followed from 20 years old until she has the first child. After data selection there are 3896 women and 2332 events left in sample. When continuous birth is the dependent variable, the year after a woman's first childbirth is viewed as the start point of "at risk". Normally the birth interval is less than eight years, which means most women tend to have next birth within eight years since last birth. Hence, a woman's person-year observations after 8 years of her last birth are dropped out. There are 4046 women and 2783 high order childbirths in the filtered sample.

In order to examine the influence of socioeconomic factors and parental family background, I use total children as the dependent variable. Female respondents younger than 50 years old in a specific survey years are included in this sub-sample. There are 4024 women with a median age at 36.2. The average number of children is 1.36. Women under age 30 are also grouped, with the purpose to investigate the birth behavior in young groups.

### 3.3 Variables

#### 3.3.1 Dependent variables

Childbirth is the main focus in this thesis. Like some other types of life events, there is a delay between the decision making and occurrence. In the case of childbearing, a couple has to obtain an agreement about gestation, assuming childbirths are not unplanned. It takes some time for a woman to start a pregnancy, and then goes through nine months conception. In other words, an occurrence of childbirth now is determined at least nine months ago. Unfortunately the month of children's birthday is not available in JGSS, so I use birth year instead. Current dataset does not allow me to trace the exact time when the pregnant decision was made, therefore I assume that

childbirths at year  $t$  is affected by the labor market condition at year  $t-1$ .

*Hazard of First Births* and *Hazard of Continuous Births*. Birth is a dichotomy variable, which is one when the first birth occurs and otherwise zero. Table 1 shows number of women and births event between 1984 and 2008.

Table 1 Observations and birth events 1984-2008

| Year | First Birth |        | Continuous Birth |        |
|------|-------------|--------|------------------|--------|
|      | Women       | Births | Women            | Births |
| 1984 | 1,624       | 141    | 3,495            | 145    |
| 1985 | 1,652       | 132    | 3,494            | 148    |
| 1986 | 1,617       | 138    | 3,414            | 183    |
| 1987 | 1,652       | 110    | 3,377            | 164    |
| 1988 | 1,698       | 124    | 3,367            | 183    |
| 1989 | 1,735       | 112    | 3,362            | 149    |
| 1990 | 1,765       | 124    | 3,356            | 133    |
| 1991 | 1,796       | 132    | 3,348            | 140    |
| 1992 | 1,775       | 113    | 3,296            | 159    |
| 1993 | 1,788       | 121    | 3,292            | 149    |
| 1994 | 1,833       | 115    | 3,327            | 145    |
| 1995 | 1,840       | 129    | 3,301            | 126    |
| 1996 | 1,839       | 139    | 3,294            | 139    |
| 1997 | 1,808       | 122    | 3,245            | 123    |
| 1998 | 1,779       | 96     | 3,219            | 139    |
| 1999 | 1,765       | 117    | 3,182            | 122    |
| 2000 | 1,711       | 102    | 3,115            | 121    |
| 2001 | 1,445       | 91     | 2,641            | 108    |
| 2002 | 1,196       | 78     | 2,201            | 66     |
| 2003 | 931         | 51     | 1,719            | 82     |
| 2004 | 929         | 56     | 1,697            | 59     |
| 2005 | 901         | 46     | 1,656            | 68     |
| 2006 | 712         | 49     | 1,304            | 44     |
| 2007 | 352         | 22     | 660              | 27     |
| 2008 | 331         | 16     | 632              | 28     |

*Total number of children*. Here I select the sample, in which women are aged 20-49 in specific survey years. This variable is to capture the number of children a women have until the survey year. Its value ranges from 0 to 6, with a mean at 1,36. To better

understand the changes among different cohort, I also built another subgroup: women aged 20-29 in survey years. The average number of children for the group is 0,37,.

### 3.3.2 Contextual variables

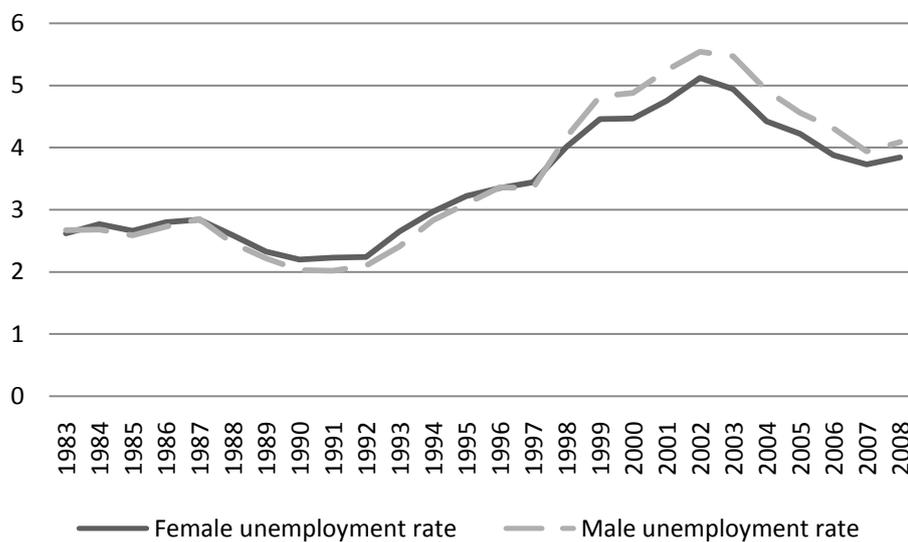
*Unemployment rate* is a time-varying covariate used as an indicator for labor market condition. While theories emphasize on the short-term fluctuations in wages of a women or her family, my empirical studies applied aggregated unemployment rate. Due to the lack of individual-level work history in open data source, I can't trace the real wages changes of a single respondent. However, using aggregated indicator does have some strength. Unemployment rate is a widely used proxy which captures both the possibility of individual job loss and the influence of general economic insecurity. Moreover, it is less likely to face endogenous problems. That is to say, in the individual level, employment and fertility may be joint-determined. In other words, while job loss may lead to less childbirth, childbearing and parental leave may increase the probability of unemployment. However, a woman's fertility behavior is unlikely to significantly influence the macro employment rate. Thus, the endogenous problem is largely mitigated.

Using macro unemployment rate indeed suffers from several problems. One limitation is that it may hide possible heterogeneity among various social groups. E.g., Genda (2001) documents that those less-educated women are shocked more strongly than highly educated women during an economic recession. Using aggregated data assumes that women in the whole society respond to economic fluctuations equally. Although I break up my sample into less-educated and well-educated women to capture the difference between these two groups, I may overlook other personal characters. Hence, I have to be more cautious in result interpretation.

There are two types of annual unemployment rates involved in the models: male unemployment rate, female unemployment rate. The country level unemployment rate is seen as a proxy of country-wide economic environment, as well as a signal of

well-being of the whole society. Figure 1 illustrates the trends of gender-specific unemployment rates between 1983 and 2008. According to the picture, Japanese total unemployment rates starts at 2.7% in 1983 and declines gradually to the bottom at 2.1% in 1991. Since then it surges during the prolonged economic recession and reach the peak at 5.4% in 2002. After that it drops slowly to around 4% in 2008. The regional unemployment rate is also checked. It turns out to generally follow the country level tendency, though some minor regional differences can be spotted. E.g., Kinki and Hokkaido or Tohoku have higher level of unemployment rates compared with the other regions, while Chubu enjoys relative lower unemployment rate. Meanwhile, Female unemployment rate is highly correlated with male unemployment rate, in both country and region level. Therefore, it is not proper to include them in the same regression; otherwise it may result in multi-correlation problem. I make two separate regressions for male unemployment rate and female unemployment rate.

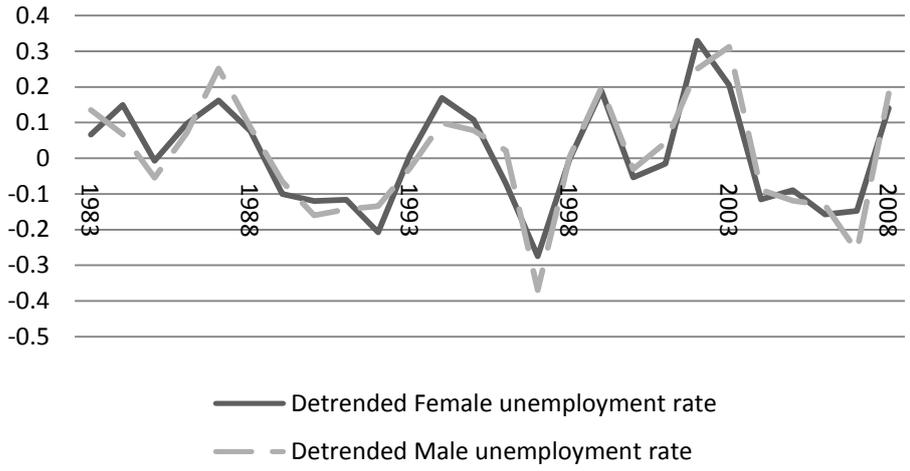
Figure 1 Male and Female unemployment rates (percentages): 1983-2008



Applying those unemployment rate series directly in regression might lead to biased estimation as they have clear tendency. In other words, the original series reflects period effects more than fluctuations in labor market. For example, an unemployment rate less than 3 basically indicates period before 1988. In order to

capture changes in labor market more precisely, Hodrick–Prescott filter is performed to remove trends in unemployment series (hprescott in Stata). Detrended series as showed in figure 2 are used in further regressions.

Figure 2 Detrended male and female unemployment rates (percentages): 1983-2008



Time-varying unemployment rates series are included in the cloglog regressions, with the purpose of studying the temporary influence of labor market condition. Furthermore, I divide the unemployment rate into 5 different groups based on their distributions: extreme low (lower than 10% percentile point), low (10%-25%), normal (25%-75%), high (75%-90%) and extreme high (higher than 90% percentile point). Table 2 lists the statistics of grouping. By categorizing the unemployment rate, it is possible to investigate whether the impact of changing labor market is linear. In fact, this effect might be asymmetry.

Table 2 Categorized detrended unemployment rates

| 1983-2008                | 10%   | 25%   | 50%  | 75%  | 90%  |
|--------------------------|-------|-------|------|------|------|
| Female unemployment rate | -0.16 | -0.10 | 0.00 | 0.11 | 0.17 |
| Male unemployment rate   | -0.16 | -0.09 | 0.02 | 0.08 | 0.20 |

*Female unemployment rate in school-graduation year.* The labor market condition a

person experiences when she enters the labor market may have long-term impacts on her fertility. Unfortunately, JGSS doesn't provide the time women transits from school to work. Since repeating or skipping grades are rare in Japan, the graduation year are inferred based on the information of the highest school a respondent completes. I assume that all junior graduates finish schooling at age 15, high school at age 18, 2-year colleges at age 20, and 4-year university at age 22. Unemployment rate at the school-graduation year is a control variable in the cloglog regression. Whilst, it also acts as a main explanatory variable in the poisson regression, by which it is aimed to find whether the labor market entry permanently impacts a woman's fertility level in her life time.

### 3.3.3 Individual level covariates

Table 3 shows the descriptive statistics of the individual-level covariates, the control variables, used in the cloglog regression. Except for the variable age-group, all the other individual-level covariates are time-constant.

Table 3 Descriptive table (in percentages): Complementary log-log model

|                    | First Birth | Continuous Birth |
|--------------------|-------------|------------------|
| Region             |             |                  |
| Hokkaido or Tohoku | 11.81       | 11.79            |
| Kanto              | 33.53       | 29.25            |
| Chubu              | 19.05       | 21.47            |
| Kinki              | 15.15       | 14.57            |
| Cyugoku or Shikoku | 9.45        | 10.35            |
| Kyusyu             | 11.01       | 12.58            |
| Survey Year        |             |                  |
| 2000               | 11.13       | 12.54            |
| 2001               | 11.46       | 11.88            |
| 2002               | 13.12       | 13.91            |
| 2005               | 11.44       | 10.82            |
| 2006               | 24.70       | 24.26            |
| 2008               | 28.14       | 26.59            |
| Age Group          |             |                  |
| 20-25 years        | 38.47       | 2.35             |
| 26-30 years        | 29.56       | 17.21            |
| 31-35 years        | 13.90       | 37.08            |

|   |       |       |
|---|-------|-------|
| 36-40 years   | 7.47  | 31.53 |
| above 40  | 10.61 | 11.82 |
| <b>Period</b>   |       |       |
| 1983-1987   | 22.51 | 27.49 |
| 1988-1992   | 24.29 | 24.01 |
| 1993-1997   | 25.00 | 22.29 |
| 1998-2002   | 19.28 | 17.82 |
| 2003-2008   | 8.92  | 8.38  |
| <b>Education Attainment</b>                                     |       |       |
| Basic   | 3.69  | 6.00  |
| High School   | 45.79 | 56.16 |
| 2-year College  | 30.54 | 25.40 |
| University  | 19.98 | 12.45 |
| <b>Size of Municipality at the Age 15</b>                       |       |       |
| Town/village  | 32.59 | 39.67 |
| Small to medium sized city                                      | 51.11 | 46.33 |
| Large city  | 16.31 | 14.00 |
| <b>Mother's Work at the Age 15</b>                              |       |       |
| Not work  | 30.81 | 28.33 |
| Temporary work  | 24.96 | 20.77 |
| Regular work  | 17.68 | 15.96 |
| Self employed   | 26.56 | 34.94 |
| <b>Comparison of Household Income with Others at the Age 15</b> |       |       |
| Far below average   | 6.90  | 7.73  |
| Below average   | 22.87 | 26.78 |
| Average   | 50.52 | 46.70 |
| Above average   | 17.92 | 16.45 |
| Far above average   | 1.79  | 2.34  |
| <b>Number of Siblings</b>                                       |       |       |
| 0   | 7.80  | 5.56  |
| 1   | 46.79 | 37.74 |
| 2   | 31.58 | 34.10 |
| 3   | 8.18  | 12.30 |
| More than 3   | 5.66  | 10.29 |
| <b>Years Since Last Births</b>                                  |       |       |
| 1   |       | 17.19 |
| 2   |       | 16.68 |
| 3   |       | 13.87 |
| 4   |       | 11.76 |
| 5   |       | 10.67 |
| More than 5   |       | 29.84 |
| <b>Number of Previous Children</b>                              |       |       |
| 1   |       | 30.36 |
| 2   |       | 47.95 |

|             |       |
|-------------|-------|
| 3           | 18.93 |
| More than 3 | 2.75  |

*Education attainment.* Female education expansion not only increases the opportunity cost of childbirths but also delays the transition to motherhood. As discussed above, females who haven't finished schooling are excluded from the sample. Since JGSS doesn't provide respondents' education history, I have to assume that women complete schooling before they enter marriage market. Education attainment is a constant variable in my regressions. I divide the level of education attainment into four categories: basic (secondary school or less), high school, 2-year college/College of technology and university. The first two categories are defined as less educated and others as well-educated. Japanese compulsory education is up till secondary school. But only a small portion of women stop their education after compulsory schooling. According to table 3, almost half of women complete their education after high school. Women with 2-year college education are common: over 25% of them graduate from junior colleges. In contrast, much fewer women get enrolled in university. Overall, the education level in first births sample is slightly higher than the continuing births subgroups, women in which are relative older. This result also reflects female education expansion in Japan: the younger age group has higher average level of education attainment.

*Number of siblings.* Family size reflects parents' fertility preference, which is believed to pass to their offspring. As shown in table 3, most women in my sample have 1 or 2 siblings. Since the portion of women who have more than 3 is small, I combine them to one category "more than 3".

*Mother's work at age 15.* It is believed that children raised by work mothers receive more information about working life and thus become more career-orientation. The preference of life may influence their procreation decisions. Mother's work includes four types: not work, temporary work, regular work and executive, and self

employment. Table 2 shows that only around 15% of mothers are in regular employments. About 60% of them are either not works or self-employed and over 20% of them work temporarily.

*Comparison of household income with others at age 15.* This constant variable is viewed as a proxy of social class of parental family. I don't select father's education, which is a more common indicator for social class, because of large number of missing values in JGSS. The selected variable provides a proxy how a person positions her family in the society. The variable is classified into five groups: average, below average, far below average, above average, far above average. About 50% of women thought their parental families are normal in the society, while only about 10% people believe they are far below average or far above average.

*Size of municipality in age 15.* There are three types of municipality size: town/village, small to medium size city, large city. The urbanization transition brings the consequence that the majority of women grow up in the urban area.

Beside time-constant covariate discussed above, I also control region and survey year. Age groups and period dummy are merged into regression as time-varying covariates.

#### 4. Childbirth and contemporary unemployment rate

This section presents how fertility response to temporary changes in aggregated labor market condition. I will interpret the result from complementary log-log model. Table 3 and Table 4 provide the exponentiated value of coefficients, which are easier to interpret. I define p-value less than 5% confidential level as "significant", less than 1% as "very significant". Following interpretation and analysis mainly focus on significant results. The overall p-value of Wald test for all regressions are less than 1%, thus the models are valid. I will start with first childbirth and then continuous births. Notice that

the exponentiated coefficients is the relative risk change compared with 1.

#### 4.1 First childbirths

According to table 4, one unit increase in female unemployment rate (1%) will respectively decrease the relative risk of giving first childbirth by 39% for the low education group, and by 52% for the high education group. One unit increase in male unemployment rate will reduce the relative risk by 37% for the low education group. For the high education group an increase in male unemployment rate also implies decline in relative risks, although it is only significant in 10% level. Hence, compared with male labor market, the aggravated female labor market, accompanied by less working opportunity, has a stronger impact on the decision making of first childbirths.

Table 4 Impact of unemployment rates on birth events: Complementary log-log model

|                             | Low Education         |                            | High Education        |                            |
|-----------------------------|-----------------------|----------------------------|-----------------------|----------------------------|
|                             | First Birth<br>exp(b) | Continuous Birth<br>exp(b) | First Birth<br>exp(b) | Continuous Birth<br>exp(b) |
| Female<br>unemployment rate | 0.61**                | 1.04                       | 0.48***               | 1.01                       |
| Male unemployment<br>rate   | 0.63**                | 1.10                       | 0.68*                 | 0.87                       |
| Observation                 | 16873                 | 19042                      | 17316                 | 11608                      |
| Number of women             | 2009                  | 2583                       | 1887                  | 1463                       |
| Events                      | 1303                  | 1651                       | 1029                  | 1132                       |

Note: \* p<0.10; \*\* p<0.05; \*\*\*p<0.01.

Control variables: region, survey year, age group, period, education attainment, size of municipality at age 15, mother's work at age 15, comparison of household income with others at age 15 and number of siblings. For continuous birth, years since last births and number of previous children are also controlled.

I further categorize the unemployment rate into 5 levels, to check whether the negative impact of unemployment rate is linear across different levels. The "Normal" level acts as reference group. Table 5 lists the results of the categorized unemployment rate. For the low education subsample, the coefficient of high level female unemployment rate is statistically significant. More precisely, under high female

unemployment rate, the hazard of entering motherhood reduces by 26% compared to reference group (“Normal”). Turn to male unemployment rate, in the “High” and “Very high” level, the risks of giving first childbirth significantly decline relative to the “Normal” group. In “High” level, the probability of transit to motherhood diminishes to a greater extent if the female unemployment rate is under study, instead of the male unemployment rate. In “Very high” level, aggravated male unemployment has stronger inverse impact on hazard of first birth. Table 5 also reveals that the influence of aggregated labor market condition is not linear, as in the low and very low categories, hazards of having first childbirth are lower than that of the normal category.

Table 5 Impact of categorized unemployment rates

|                                 | Low Education         |                            | High Education        |                            |
|---------------------------------|-----------------------|----------------------------|-----------------------|----------------------------|
|                                 | First Birth<br>exp(b) | Continuous Birth<br>exp(b) | First Birth<br>exp(b) | Continuous Birth<br>exp(b) |
| <b>Female unemployment rate</b> |                       |                            |                       |                            |
| Very low                        | 0.88                  | 0.95                       | 0,79**                | 1.09                       |
| Low                             | 0.93                  | 0.99                       | 0.86                  | 1.06                       |
| Normal                          | -                     | -                          | -                     | -                          |
| High                            | 0,74***               | 0.98                       | 0,70***               | 0.95                       |
| Very high                       | 0.90                  | 1.02                       | 0.84                  | 1.09                       |
| <b>Male unemployment rate</b>   |                       |                            |                       |                            |
| Very low                        | 0.91                  | 0.99                       | 0,78**                | 0.99                       |
| Low                             | 0.89                  | 1.03                       | 0,75**                | 1.13                       |
| Normal                          | -                     | -                          | -                     | -                          |
| High                            | 0,87*                 | 0.91                       | 0,80***               | 1.01                       |
| Very high                       | 0,65***               | 1.15                       | 0,73***               | 1.17                       |
| Observation                     | 16873                 | 19042                      | 17316                 | 11608                      |
| Number of Women                 | 2009                  | 2583                       | 1887                  | 1463                       |
| Events                          | 1303                  | 1651                       | 1029                  | 1132                       |

Note: \* p<0.10; \*\* p<0.05; \*\*\*p<0.01.

Control variables: region, survey year, age group, period, education attainment, size of municipality at age 15, mother’s work at age 15, comparison of household income with others at age 15 and number of siblings. For continuous birth, years since last births and number of previous children are also controlled.

According to table 5, labor market condition plays a similar role on fertility for highly educated women when female and male unemployment rates are in high and

very high level. However, when male unemployment rates are in low and very low level, the hazard of entering motherhood reduce by 25% and 23% compared with reference group (“Normal”). When female unemployment rate lies in the “Very low” level, the hazard of giving first childbirth decreases relative to reference group.

Estimated results from categorized unemployment rates show that relative risk of having first childbirths significantly decrease in a slack labor market. Deteriorated female work chance has stronger negative influence than male work chance does. But in extreme bad times, marked with “Very high” unemployment rates, men’s employment situation has lager impact. It is interesting to see that most coefficients for very low and low categories are significant at 5% confident level for high educated group. Overall, when the labor market condition is good, the relative risk of entering motherhood declines.

## 4.2 Continuous childbirths

Since none of the coefficients is statistically significant, labor market fluctuations do not alter the continuous childbirths much. Nevertheless, I still interpret the estimated results, with a focus on the direction of effects.

Exponentiated value of coefficients for female unemployment rate are very close to one, which indicates that female market condition has almost no influence on the high order births. Conversely, male unemployment seems to have positive link to hazard of continuous births among less educated women. Hence, when men’s labor market condition becomes worse, the relative risk of having second or more children increases. The role of male employment situation works differently for highly educated women. It seems negatively correlated to the continuous birth, with an exponentiated coefficient 0.87.

## 4.3 Discussion

On the whole, the unemployment rate has strong impact on first birth, but does not alter continuous births. Moreover, the responses of fertility are different to gender-specific unemployment rates across different education groups.

Changes in male labor market condition play a similar part on female first childbirths with regardless of education background. Increased male unemployment rate gives rise to the reduction in the relative risk of giving first childbirths. This could be mainly attributed to the “income effect”. Male wages loss, accompanied by unemployment, lowers the family’s total income, hence reduces the demand of children. Especially in Japan, family income mainly relies on husband’s wage, as male’s breadwinner role rooted in the social norm. Moreover, fewer employment opportunities may hinder transition to parenthoods by the means of delaying marriages. Delayed marriage will inevitably postpone the first birth, given that out-of-wedlock childbirths are rare in Japan. According to Genda (2001), youth are shocked most by economic downturn because of the rigid labor market institution. As a result, a lot of Japanese youth get involved in non-regular employments, which leads to potential low income. Plus, since male status hypogamy is prevalent in marriage market, the situation becomes even worse for youth with low income. Thus, it is reasonable to say that less work opportunities prevents young men from marriages. When male work market is slack, the relative risk of motherhood entry is lower, compared to normal times.

In individual level, the negative linkage between male unemployment rate and hazard ratio of first childbirths accords with the spillover hypothesis (Zedeck 1992). Success in career life (increased wage) tends to result in success in family. Similar results in West Germany are reported by Tölke and Diewald (2003). However, according to Table 5, the relative risk of first childbirths also reduces when aggregated labor conditions are better than normal time. This phenomenon is not consistent with either income effects or spillover hypothesis. I try to connect it with female work opportunities. In Japan, males and female labor market are highly positive correlated. Consequently, there are more work opportunities for women when male

unemployment rate are very low. Women are getting employed easier. Opportunity cost of childbearing for working women is relative higher than those who don't work. Hence, the probability of giving childbirths is lessened.

The timing of first births is more sensitive to female labor market fluctuations than to male unemployment changes. Well-educated women response greater. Let's first focus on effects of slack labor market. The relative risk of first childbirth is reduced by over 50% with one unit increase in female unemployment rate. When wages decrease (unemployed), the opportunity cost and income decrease at the same time. In the case of Japan, income effect plays the main role. Depressed economy environment brings unease to everyone. Women may choose to put off marriages and first childbirth to later improved period. Normally women have to temporarily leave job after childbearing. During an economic depression, women may presume that the chances of re-employment are small after childbearing. Thus, the opportunity cost of having childbirth becomes very high, especially for well-educated woman who have a decent job. Japanese employment practices encourage continuous work. There is less room for substitution between childbirths and work as in the U.S. case. Therefore, the counter-cyclical connection from (Butz and Ward 1979) does not exist in Japan, at least during economical recessions. The suppress influence is consistent with the previous finding by Higuchi (2001).

On the other hand, in times of labor shortages when female unemployment is very low, there are more work chances for women. The reduced hazard of motherhood entry may be explained by that substitution effect exceeds income effect. Although the trend exists in both education groups, all significant results are from higher educated group. Female college graduates are more likely to have a regular full-time job. Thus their substitution effects are much stronger.

In contrast, continuous birth seems not be affected by aggregated labor market condition. Female unemployment rates have almost no impact. Women employment in

Japan has an “M” shape pattern. Women leave their job soon after marriage or first childbirth. Since social norm presumes that mothers should take the main responsibility of childcare and housework, women usually stay at home until their children grow elder and then go back to work. For this reason, the female labor force participation rate drops greatly in their late 20s and bounds back at around their 40s. During the period when they stay at home, labor market fluctuation should not have great influence. As they don’t have income from job, the substitution effect becomes negligible.

Though not supported by the empirical results above as none of coefficients are significant, theoretically male market condition may influence continuous birth by altering husbands’ income or employment status. Though not significant, for both high and low educated group, the relative risk of having more children increases when male labor market conditions are very slack. In individual level, it may be attributed to compensatory explanation that men may rely more on family when they face problem in working life.

I will end the part by responding to hypothesis 1 and 3. Since labor market condition has little influence on continuous birth, I focus on first births. Hypothesis 1 is evidently true. First births are changed because of fluctuations in both male and female unemployment rates. Gender-specific labor market influences fertility in the same direction, although the strength has minor difference. Hypothesis 3 is confirmed for first births. The response to labor market is similar regardless of education background, although well-educated women show stronger adjustment toward fertility behaviors.

## 5. Number of children and labor market entry

Labor market condition a person experiences when graduates has persistent impact on his/her sequent work and income in Japan (Genda et al. 2010). By presenting and discussing the connection between total fertility and female unemployment rate at

graduation, I aim to figure out whether labor market condition in graduation year alters total number of children across various education levels.

## 5.1 Results

Less educated women and higher educated women are treated as two different subsamples. Table 6 shows estimated results of the poisson regression. Negative signs of coefficients indicate that total number of children is expected to decrease if a covariate increases. All the coefficients are not significant at 5% confident level. I mainly describe the signs of the coefficients of the two education groups. Overall, an increase in the female unemployment rate in graduation year reduces the number of children of less-educated women. The negative effects become stronger for the age group 20-49 than the age group 20-29. On the contrary, well-educated women tend to have more children if they experience labor market downturn when they graduate. The coefficient for the age group 20-29 is 0.63. But the positive relation fades away in the higher age group 20-49.

Table 6 Connection between labor market entry condition and total childbirths:

Poission estimation

|  | Low education |             | High education |             |
|--|---------------|-------------|----------------|-------------|
|  | Age 20-49     | Age 20-29   | Age 20-49      | Age 20-29   |
|  | Coefficient   | Coefficient | Coefficient    | Coefficient |
| Female unemployment rate at graduation | -0.10         | -0.03       | 0.02           | 0.63        |
| Number of Observations                 | 2127          | 424         | 1897           | 528         |

Note: \*  $p < 0.10$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ .

Control variables: region, survey year, age group, education attainment, size of municipality at age 15, mother's work at age 15, comparison of household income with others at age 15 and number of siblings.

## 5.2 Discussions

The main interesting thing here is the opposite direction across education levels. For

high-educated women, the substitution effect is stronger during the labor market downturn. In other words, they may choose to have children when their income is lower. It is possible that less-educated women suffer more from income effects than their well educated counterparts do. Genda et al. (2010) suggest that low-educated persons experience greater continuous income losses during the labor market downturn. From the other aspect, high-educated women are more likely to marry men with high income, who are hardly influenced by labor market fluctuation.

Another explanation is that non-regular workers are more common in the less-educated population than in the well-educated one. Life-time employment brings the two-tier structure among employers. Compared to regular workers, non-regular workers not only earn much less wages but also suffer from higher work instability during an economic stagnation and recession. Moreover, most non-regular workers have little job security. It is more difficult for them to keep job position after childbearing. In fact, temporal employments are found to be negative correlated to marriages in Spain (Ahn and Mira 2002). Similar mechanisms may exist in Japan. All those factors lead to negative impacts of labor market entry condition for less-educated women.

My results somehow go against with Hashimoto and Kondo (2012)'s findings, which shows that labor market condition in school-graduation year has significant influence on sequent fertility behaviors, although the direction of effects for the two education groups are the same. The fact that different data and models are used may explain the conflicting results. Plus, they focus on the timing of births, while my thesis emphasizes on total number of children. Changing timing of childbirth does not necessarily indicate changes in number of children a women have.

## 6. Impacts of social economic characters on total fertility

Table 7 shows the outputs from the poisson regression. Below the head are there coefficients of categorized covariates for women who are 20-49 year-old, and 20-29 year-old in survey years.

Table 7 Socioeconomic factors and total number of children: Poisson estimation

|   | Age 20-49 |             | Age 20-29 |             |
|---|-----------|-------------|-----------|-------------|
|   | Mean      | Coefficient | Mean      | Coefficient |
| <b>Education Level</b>  |           |             |           |             |
| Basic   | 3.45      | -           | 1.66      | -           |
| High School   | 49.4      | -0.43***    | 42.41     | -1.36***    |
| 2-year College  | 29.45     | -0.54***    | 31.29     | -1.87***    |
| Unviversity   | 17.69     | -0.76***    | 24.64     | -2.59***    |
| <b>Size of Municipality at the Age 15</b>                       |           |             |           |             |
| Town/village  | 33.97     | -           | 30.87     | -           |
| Small to medium sized city                                      | 51.44     | -0.10***    | 56.24     | -0.14       |
| Large city  | 14.59     | -0.09*      | 12.89     | -0.21       |
| <b>Age Group</b>  |           |             |           |             |
| 20-25 years   | 10.24     | -           | 42.83     | -           |
| 26-30 years   | 13.67     | 0.19***     | 57.17     | 1.25***     |
| 31-35 years   | 17.45     | 1.02***     |           |             |
| 36-40 years   | 19.36     | 1.30***     |           |             |
| above 40  | 39.29     | 1.41***     |           |             |
| <b>Mother Work at the Age 15</b>                                |           |             |           |             |
| Not Work  | 27.56     | -           | 26.51     | -           |
| Temporary Work  | 26.14     | -0.03       | 33.99     | 0.13        |
| Regular Work  | 18.91     | -0.04       | 21.93     | 0.14        |
| Self Employed   | 27.39     | 0           | 17.57     | -0.1        |
| <b>Comparison of Household Income with Others at the Age 15</b> |           |             |           |             |
| Far below average   | 6.36      | -0.05       | 4.47      | 0.58***     |
| Below average   | 23.19     | 0           | 17.46     | -0.01       |
| Average   | 50.6      | -           | 56.65     | -           |
| Above average   | 17.89     | 0.09**      | 20.06     | 0.34**      |
| Far above average   | 1.96      | 0.12        | 1.35      | 0.4         |
| <b>Number of siblings</b>                                       |           |             |           |             |
| 0   | 6.91      | -0.14***    | 7.17      | -0.53*      |
| 1   | 46.57     | -           | 51.77     | -           |
| 2   | 33.2      | -0.18       | 33.06     | 0.18        |
| 3   | 8.47      | 0           | 6.86      | 0.24        |
| More than 3   | 4.85      | -0.01       | 1.14      | 0.13        |
| Female unemployment rate at graduation                          |           | -0.03       |           | 0.55        |
| Number of Observations  |           | 4024        |           | 962         |

Note: \*  $p < 0.10$ ; \*\*  $p < 0.05$ ; \*\*\* $p < 0.01$ .

Control variables: region, survey year and age group.

## 6.1 Education attainment

Increasing education level significantly reduces the total number of children. First look at education in the age group 20-49, the coefficient for “High School” indicates the expected difference in log count between high school graduates and the reference group (basic). Compared with “basic”, the reference group, the expected log count for “High School” decreases by 0.43. Similarly, the expected log count for “2 year college” reduces by 0.54 relative to the reference group. Hence, compared with junior secondary graduates, high school graduates have less number of children. Colleges’ graduates have even lower fertility level. All the coefficients are statistically significant at 1% confident level. This pattern is consistent with the younger age group. In the 20-29 age groups, the difference between reference group and other education level are greater, since the coefficients become larger as education level increase. Hence, higher education a woman obtain, the less children she has. Moreover, the negative impact of education expansion is stronger in younger cohort.

The negative link between education attainment and number of children coincides with hypothesis 4. The significant inverse coefficients in age group 20-29 indicate that higher education attainment has a negative impact on transition to motherhood. It may be because of higher probability of workforce participation for highly education women or just longer time staying in school. Moreover, increase education relative to men make mating more difficult in Japan where hegemony masculinity still dominates. Education also lessens the total fertility in older age. The result is consistent with previous findings (Raymo and Iwasawa 2005).

## 6.2 Family of origin and place of upbringing

I start with the number of siblings. Overall women without sibling have significantly

less children than those have one sibling. Among age group 20-49, the expected log count for women who are only child in their family reduce by 0.14 compare with those who have one sibling (the reference group). Surprisingly, siblings more than one also decrease the number of children, although there are not statistically significant. For the younger age group 20-29, no sibling has greater difference relative to 1 sibling (-0.53 log count). Moreover, more siblings tend to have positive impact the number of children women have.

The difference between no sibling category and one sibling category accords with hypothesis 5a. It shows that parents' fertility preference and behavior are transmitted to their offspring. In addition, more experience of close relationship and greater kinship support from larger family make partner hunting and childbearing relative easier (Murphy and Wang 2001). Alternatively, although not statistical significant, negative signs, , in lager number of siblings among age group 20-49 suggest that Easterlin's hypothesis (Easterlin 1969) may exist on older age groups. People raised in larger family are relative economical disadvantaged, thus their consumption demands are lower. Hence, comparative improved economic situation may enhance their fertility. Still, the positive impact of parental fertility pattern dominants my sample.

The coefficients of "Comparison of Household Income with Others at Age 15" indicate that women from economical advantage family tend to have more children. In group 20-29, the category "above average" increases the log count by 0.34, compared to the baseline group ("Average"). The "far above average" group has even more children. One the other hand, while the coefficient of "below average" is negative, the lowest income group has a positive and significant coefficient. It shows that women from the lowest income group tend to have more children until 30 than "Average" group. The results from age group 20-49 are consistent with the younger group regarding higher income women. But it suggests that those grow up in poorer family have less children compared to the reference group ("Average").

The results indicate that financial resource of parental family positively influences the total fertility for those from economical advantage family. It coincides with hypothesis 5b and previous findings which show higher income family provide more financial support to children. However, the impact among lower income family is unclear. The positive sign among 20-29 may be explained by Easterlin's hypothesis (Easterlin 1969), which assumes women from poor family tend to have more children if their current situations are better than that in parents' home. Moreover, poorer family background may suggest low education level which assuming to marry earlier. The conflict results among two age groups may suggest that women from lower income family transit into motherhood in younger age, but overall they will have fewer children in the life time.

Mother's work seems not have strong impact on children's fertility level, since none of coefficients is statistical significant. In 20-29 age group, women whose mother work temporary or regularly have more children than those mother do not involve in paid work. It may imply that dual-worker parents may be economical advantaged and provide more support for daughters to set up family. However, the pattern in age 20-49 is reverse. Mother's labor force participation tend to lower children's fertility level, which can be explain by transmission of life pattern from mother to daughter. Moreover, the similar values of temporary work and regular work suggest that types of mother employment do not act differently on children's fertility. But still evidences are not enough to support hypothesis 8.

The last covariate discussed here is place of upbringing. It is clear that women raised in cities have less fertility level than those grow up in rural area. The outcomes accord with hypothesis 9. Although the coefficients are not statistically significant among age group 20-29, they are significant in age group 20-49. The results are also similar with the findings in West Germany (Blossfeld and Huinink 1991).

## 7. Conclusion

This thesis aims to examine how female fertility behavior responds to the changes of aggregated labor market condition in both short-term and long-term. Empirical analysis based on Japanese micro data shows that labor market fluctuations indeed affect fertility in the short run. At the same time, female unemployment rate in the school-graduation year, which is used as indicator of persistent income changes, does not have significant long-term impact on total fertility.

Under a slack labor market condition, the relative risk of transiting into motherhood declines, regardless of which education background. High unemployment rate, which indicates higher possibility of wage reduction and job losses, lowers women's time value and at the same time decreases total family income. Income effect dominates when the unemployment rates are high. When unemployment rates are low, the story is different. For well-educated women, relative probability of having first child decreases since substitution effects exceed income effects. Nonetheless, such pattern does not exist for low educated women. As well-educated women are more likely to have a better job, they have higher opportunity cost of childbearing.

Now let's revisit the main hypothesis. Hypothesis 1, which presumes that labor market condition affects contemporary fertility behaviors, is only confirmed in the case of first childbirth. Changes in contemporary employment rates have obvious impact on first childbirth, while having little pressure on continuous childbearing. Men and female labor market condition impact female fertility in the same direction but with different strengths. Since there is no evidence supporting that graduation-year labor market condition has any obvious impacts on the total number of children, hypothesis 2 is rejected. Hypothesis 3 raises assumptions about heterogeneity. It is proved in the case of first childbirth. Particularly, for one unit increase in female unemployment rate, the relative risk of having first childbirth decreases more for well-educated women than for less-educated ones. Under good labor market condition, high-educated groups tend

to have less childbirth compared to normal times. This tendency does not exist for less-education women.

Besides labor market, I also examine the influence of education attainment and family of origin. As expected, education level is negatively correlated to total fertility level. That is to say, the rising female education level can be seen as an important factor in explaining the declining fertility rate. The result also suggests that parents' fertility preference is transmitted to offspring. Women who grow up in rich family and rural area are more likely to have more children. Whether the respondent's mother participates in paid work has little impact on respondent's fertility level.

This thesis makes some contributions to existing literatures. Firstly, I find that while slack labor market condition postpones women's first childbirth, the impacts from the graduation-year labor market condition on total fertility is ignorable in the long term. Deterioration employment market should not be blamed for the continuous fertility decline in Japan. Secondly, the income effects and substitution effects act differently under distinct circumstances. In Japanese case, the connection between economic fluctuation and first childbirths turns out to be pro-cyclical in economical depression and counter-cyclical during expansion times. Last but not least, I discover that reactions of fertility behaviors are different across education backgrounds. Overall, high-educated women are more sensitive to labor market changes, especially for female unemployment rate variations.

There are several limitations in my study. JGSS is not a panel dataset and I could not trace other life events of each respondents. E.g., I don't know women's work status when she decides to get pregnant. The working experience and income level may alter the respond's sensitivity to labor market change. In addition, owing to limited sample size, the potential difference across birth cohorts are not studied. These interesting topics may be studied further in the future with larger data sample.

Acknowledgements: The Japanese General Social Surveys (JGSS) are designed and carried out by the JGSS Research Center at Osaka University of Commerce (Joint Usage / Research Center for Japanese General Social Surveys accredited by Minister of Education, Culture, Sports, Science and Technology), in collaboration with the Institute of Social Science at the University of Tokyo. The 2008 dataset are distributed by SSJ Data Archive, Institute of Social Science, the University of Tokyo. Cumulative data 2000-2003, 2005, 2006 are distributed by Inter-university Consortium for Political and Social Research.

## Reference

- Adsera, A. 2005. "Vanishing Children: From High Unemployment to Low Fertility in Developed Countries." *The American Economic Review* 95(2):189-193.
- Ahn, N. and P. Mira. 2002. "A note on the changing relationship between fertility and female employment rates in developed countries." *Journal of Population Economics* 15(4):667-682.
- Becker, G.S. 1965. "A Theory of the Allocation of Time." *The Economic Journal* 75(299):493-517.
- . 1973. "A Theory of Marriage: Part I." *Journal of Political Economy* 81(4):813-846.
- Becker, G.S., Duesenberry, James S. & Okun, Bernard. 1960. "An Economic Analysis of Fertility." Pp. 209-231 in *Demographic and Economic Change in Developed Countries*, edited by U.-N. Bureau. Princeton, NJ: Princeton University Press.
- Blackburn, M.L., D.E. Bloom, and D. Neumark. 1993. "Fertility timing, wages, and human capital." *Journal of Population Economics* 6(1):1-30.
- Blossfeld, H.-P. and J. Huinink. 1991. "Human Capital Investments or Norms of Role Transition? How Women's Schooling and Career Affect the Process of Family Formation." *American Journal of Sociology* 97(1):143-168.
- Brewster, K.L. and R.R. Rindfuss. 2000. "Fertility and Women's Employment in Industrialized Nations." *Annual Review of Sociology* 26(1):271-296.
- Bryman, A. 2004. *Social research methods*. Oxford: Oxford University Press.
- Butz, W.P. and M.P. Ward. 1979. "The Emergence of Countercyclical U.S. Fertility." *The American Economic Review* 69(3):318-328.
- Dehejia, R. and A. Lleras-Muney. 2004. "Booms, Busts, and Babies' Health." *The Quarterly Journal of Economics* 119(3):1091-1130.
- Dribe, M. and M. Stanfors. 2009. "Education, Work and Parenthood: Comparing the Experience of Young Men and Women in Sweden." *Journal of Family and Economic Issues* 30(1):32-42.
- Easterlin, R.A. 1969. "Towards a socio-economic theory of fertility: A survey of recent research on economic factors in American fertility." in *Fertility and Family Planning: A World View*, edited by S.J. Behrman: University of Michigan Press.
- Fuwa, M. 2004. "Macro-Level Gender Inequality and the Division of Household Labor in 22 Countries." *American Sociological Review* 69(6):751-767.
- Genda, Y., A. Kondo, and S. Ohta. 2010. "Long-Term Effects of a Recession at Labor Market Entry in Japan and the United States." *Journal of Human Resources* 45(1):157-196.
- Genda, Y.K., M. 2001. "Transition from School to Work." *Journal of the Japanese and International Economics* 15:465-488.
- Gutiérrez-Domènech, M. 2008. "The impact of the labour market on the timing of marriage and births in Spain." *Journal of Population Economics* 21(1):83-110.
- Hashimoto, Y. and A. Kondo. 2012. "Long-term effects of labor market conditions on family formation for Japanese youth." *Journal of the Japanese and International Economics* 26(1):1-22.
- Hidaka, T. 2010. "Masculinity and the family system: The ideology of the "Salaryman" across three generations." in *Home and Family in Japan: Continuity and Transformation*, edited by R.R.a.A. Alexy. London and New York: Routledge.
- Higuchi, Y. 2001. "Women's Employment in Japan and the Timing of Marriage and Childbirth." *Japanese Economic Review* 52(2):156-184.
- Huttunen, K.K., Jenni. 2012. "The effect of job displacement on couples' fertility decisions." Munich

Personal RePEc Archive: Helsinki Center of Economic Research.

Kohler, H.-P., F.C. Billari, and J.A. Ortega. 2002. "The Emergence of Lowest-Low Fertility in Europe During the 1990s." *Population and Development Review* 28(4):641-680.

Kondo, A. 2011. "Gender-specific labor market conditions and family formation." *Journal of Population Economics* 25(1):151-174.

Murphy, M. 1999. "Is the relationship between fertility of parents and children really weak?" *Biodemography and Social Biology* 46(1-2):122-145.

Murphy, M. and D. Wang. 2001. "Family-Level Continuities in Childbearing in Low-Fertility Societies." *European Journal of Population/Revue européenne de Démographie* 17(1):75-96.

National Institute of Population and Social Security Research. 2008. "Population Statistics of Japan 2008." Tokyo.

Oppenheimer, V.K. 1988. "A Theory of Marriage Timing." *American Journal of Sociology* 94(3):563-591.

Perry, C.D. 2004. "Economic well-being and the family." Dept. of Economics, Massachusetts Institute of Technology.

Rabe-Hesketh, S. and A. Skrondal. 2008. *Multilevel and Longitudinal Modeling Using Stata*. College Station, Tex: Stata Press.

Raymo, J.M. and M. Iwasawa. 2005. "Marriage Market Mismatches in Japan: An Alternative View of the Relationship between Women's Education and Marriage." *American Sociological Review* 70(5):801-822.

Retherford, R.D., N. Ogawa, and R. Matsukura. 2001. "Late Marriage and Less Marriage in Japan." *Population and Development Review* 27(1):65-102.

Rijken, A.J. and A.C. Liefbroer. 2009. "Influences of the family of origin on the timing and quantum of fertility in the Netherlands." *Population Studies* 63(1):71-85.

Statistic Bureau. Various Years. "Labour Force Survey." in *1953-2008*. Tokyo.

Tölke, A. and M. Diewald. 2003. "Insecurities in employment and occupational careers and their impact on the transition to fatherhood in Western Germany." *Demographic Research* 9(3):41-68.

Tanioka, I., Michio Nitta, Noriko Iwai, and Tokio Yasuda. 2005. "Japanese General Social Survey (JGSS)." Ann Arbor, MI: Inter-university Consortium for Political and Social Research.

Tanioka, I., Noriko Iwai, Michio Nitta, and Hiroki Sato. 2000-2003. "Japanese General Social Surveys (JGSS) Cumulative Data." Ann Arbor, MI: Inter-university Consortium for Political and Social Research.

Tanioka, I., Noriko Iwai, Michio Nitta, and Tokio Yasuda. 2006. "Japanese General Social Survey (JGSS)." Ann Arbor, MI: Inter-university Consortium for Political and Social Research.

—. 2008. "Japanese General Social Survey (JGSS)." University of Tokyo: SSJ Data Archive.

Thornton, A. 1980. "The influence of first generation fertility and economic status on second generation fertility." *Population & Environment* 3(1):51-72.

Zedeck, S. 1992. *Work, families, and organizations*. San Francisco: Jossey-Bass.