

Chapter 2

Cohort Analysis of Pregnancy Attempts

Abstract The number of pregnancy attempts that do not result in live birth is estimated for the cohorts born between 1953 and 1988 (sampled every five years) based on data for age-specific fertility rates from the *Vital Statistics* of Japan and on a theoretical model of the probability of infertility and spontaneous abortions derived from the literature on medicine and demography studies. I obtain an age profile to use for estimating the probability of pregnancy attempts by women in each cohort. For women born in the 1950s, the probability of a pregnancy attempt was high in their 20s, at 20 %, and rapidly decreased in their 30s. For women born in the 1960s, the rate was 10–15 % in their 20s and rapidly decreased in their 30s. The cohort total fertility rate thus started to decline in the 1960s cohort, due to declines in marriage and a delayed social life-cycle. For women born after the 1970s, this trend has continued. Reproduction is now mainly conducted by women in their 30s. Despite the considerable increase in the number of pregnancy attempt by women older than 35 years in today's Japan, the number of childbirths has not increased, because of the increasing possibility of infertility and spontaneous abortions stemming from biological causes.

Keywords Estimated pregnancy attempt • Postponing childbirth • CTRF (cohort total fertility rate) • Abortion • Infertility

2.1 Life Course as a Sociological Perspective

A life course is defined as ‘a sequence of socially defined events and roles that the individual enacts over time’ (Giele and Elder 1998: 22). The life course perspective enables a holistic understanding of lives over time and across changing social contexts (Daaleman and Elder 2007). The concept of ‘cohort’ is a useful tool for the life course study. ‘Ryder (1965) proposed the term cohort as a context for studying the life course in relation to social change. Cohort refers to the age at which people enter a social system; thus, a birth cohort locates people in history according to their year of birth’ (Shanahan et al. 2003: 192). I adopt the concept

of ‘birth cohort’ to describe and investigate how Japanese society has followed its lowest-low fertility. Hereafter, I use ‘cohort’ to mean ‘birth cohort’.

After the 1980s, Japanese society faced lower fertility mainly due to marriage decline. This phenomenon, which was new at the time, continues even today. Japanese society still has difficulty dealing with this phenomenon, even though it recognizes that this fertility decline will have a significant impact on population structure in the future. The objective of this chapter is to review the basic situation of this fertility decline by conducting an analysis of pregnancy attempts within a cohort.

2.2 Cohort Total Fertility Rate

Cohort Total Fertility Rate (CTFR) is the index of fertility for a given generation. It is calculated by adding together the past fertility rate for each age (15–49) for the group of women who all were born in the same year (cohort). As displayed on the graph in Fig. 2.1, the bell-shaped curves indicate the age-specific fertility rate (i.e., the number of childbirths per woman of a specific age per year), and the CTFR is equal to the area between the curve and the X axis. The CTFR cannot be calculated until a given cohort reaches the age of 50, because it is only at 50 that a cohort is considered as having finished all of their reproduction processes. Therefore, TFR (the fertility rate for a given year adjusted for the age structure difference in the female population) is often used instead.

The TFR and CTFR will be the same when the fertility rate by age is the same among all cohorts. However, in reality fertility behaviour varies by cohort (Ministry of Health, Labour and Welfare 2015). TFR is convenient for forecasting, but confirmation by CTFR is necessary.

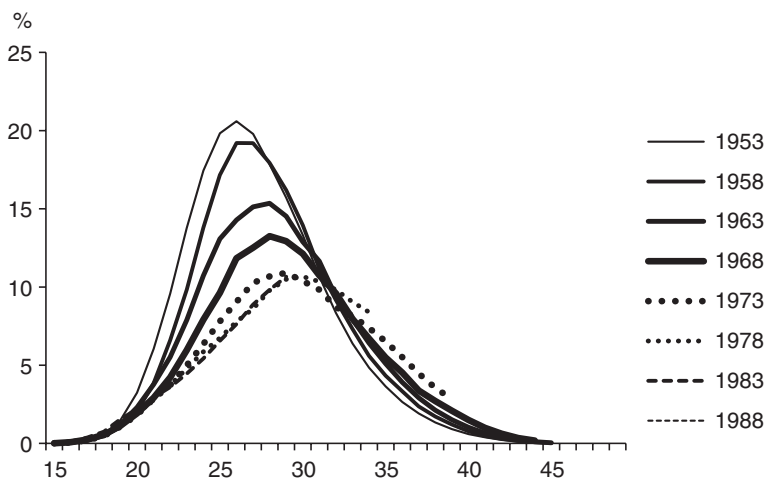


Fig. 2.1 Birth cohorts (1953–1988) and the age-specific fertility rate (%). Source *Data Vital Statistics*, 1968–2012

In Japan, the CTFR fell sharply in the 1960s cohort: as can be seen in Fig. 2.1, the lines for '1963' and '1968' are at lower positions than those for '1953' and '1958'. Why did the CTFR fall so sharply in the 1960s cohort? This book aims to examine the cause from the perspective of the relationship between women's fertility behaviours and their employment behaviours.

2.3 Trends in the Fertility Rate by Age and by Birth Cohort

We will begin by looking at the overall situation of fertility decline in Fig. 2.1. The graph shows the fertility rate at each age among women who were born between 1953 and 1988. The observation ends in 2012 because that is the most recently available data on the number of births. In the following analysis, the data used for the estimates is grouped in five-year increments: 20–24, 25–29, etc. to 45–49. Therefore, it is sufficient for the upper age of the age groups by five-year increment hits the year 2012 (i.e., this allows the data to be analysed all the way to 2012). Specifically, it is ideal to analyse the cohorts that consist of individuals who were born in a year with the last digit of '3' or '8'. For example, since $2012 - 1968 = 44$, analysing the 1968 cohort will allow us to use the data for the 40–44 years old.

Likewise, since $2012 - 1963 = 49$, analysing the 1963 cohort will allow us to use the data for 45–49 years old.

The highest fertility rate for the 1953 cohort was 20.6 %, which was observed in 1976, when members of the cohort were 26 years old. This value fell to 2.6 % at when the members of the cohort reached age 36. For the most part, this cohort completes their reproduction process in their early 30s.

For the subsequent cohorts, fertility during their 20s declined. According to Fig. 2.1, the greatest decline in fertility among those in their 20s occurred between the 1958 and 1963 cohorts. Fertility among those in their 20s continued to fall afterwards; however, it stopped its decline in the 1973 cohort, as well as in later cohorts.

Compared to the considerable fertility decline that began in the early years among those in their 20s, the change in births among those in their 30s occurred more slowly. Although the 1963 and 1968 cohorts' fertility during their 20s was significantly lower compared to the 1950s cohort, their fertility in their 30s was almost the same as that of the 1950s cohort.

Births given among those in their 30s or older began to increase in the later cohorts. Compared to prior cohorts, childbirths up to the age of 39 (in 2012) increased in the 1973 cohort, shifting the fertility rate curve to the right. In the 1978 cohort (the data is available only for those up to 34 years old), the drop in the fertility rate between their late 20s and early 30s was much smaller than that of the prior cohorts (i.e., they continued the reproduction process into their 30s). Although the fertility rate of its members in their 20s fell considerably in the 1970s cohort, the reproduction process continued into their 30s, while their fertility rate in their late 30s increased.

If the increase in their fertility rate in their 30s was large enough to offset the decrease in the fertility rate in their 20s, it only means that the timing of childbirth shifted from the 20s to 30s, and that the CTFR would not be lower when compared to the previous rate. However, the increase in births by women in their 30s or older among those in the 1963 and later cohorts was not enough to compensate for the fertility decline they experienced in their 20s. Overall fertility, therefore, continues to trend down in the younger cohorts (Moriizumi 2007).

2.4 Analytical Perspective of This Chapter

The most popular model for the theoretical explanation of this phenomenon is that the timing of childbirth and the number of children in a family are determined by the rational decisions of the involved parties (Ohbuchi et al. 1998; Takayama et al. 2000). The woman's (or couple's) intentions and plans for childbirth are certainly important in making a decision about giving birth; this is confirmed by the data analyses of Yamaguchi (2004, 2009) and Senda (2007). Japan's central government and local governments also use this kind of model to design countermeasures to the falling fertility rate. 'Reforming the way of work based on the keyword 'work-life balance'', 'expanding childcare services in the local community', and 'providing economic support to families that are raising children' are the three pillars of one such policy (Moriizumi 2010; Kamata 2010). All three pillars are based on the idea that the woman herself, or the couple, rationally make a decision regarding childbirth.

However, the 'outcome' of whether to give birth sometimes does not coincide with the intention of the parties. Iwasawa (2002) used data from the *11th National Fertility Survey* (1997) to analyse fertility intentions for additional births. She calculated the incidence of various combinations of intentions and outcomes. The results indicated the following: (1) a substantial proportion of births in contemporary Japan are unintended ones (i.e., the cases of births where the parents did not want a child or wanted a child later), and (2) there are also a considerable number of cases that do not lead to birth despite the parents' intention for additional births. These results demonstrate that the probability of a pregnancy attempt leading to an actual pregnancy, and then to childbirth, is an important factor in determining fertility, as well as whether a pregnancy attempt is made by a woman and man.

When the time frame for having children is delayed, these unintended fertility determinants become more important. This is because it is empirically known that the probability of pregnancy declines as the woman and man age, and the probability of spontaneous abortion and the risks in pregnancy and childbirth also increase for the mother. These issues were not so critical in the past because most women used to give birth in their 20s, as seen in Fig. 2.1. Then, the difference between the number of births and the parents' attempts to have children was not so large as to be a problem. In other words, the model in which couples rationally make decisions regarding whether to have a child was able to explain fertility. The fertility behaviour of the 1950s cohort can be explained by the 'rational decision-making of the parties' model.

However, the early 30s age groups have the largest number of births since 2005 (*Vital Statistics*). The number of women who give birth in their late 30s has begun to increase. Those who gave birth in their 40s or later also increased. In this way, the increase in births at an age when the probability of pregnancy declines, and the probability of spontaneous abortion rises, shows that we cannot ignore the number of deliberate attempts in which parents want a child that do not lead to birth. It is becoming apparent that the model in which couples make rational decisions faces limitations in explaining fertility, making it necessary to conduct a new analysis in order to estimate the extent to which pregnancy attempts are made.

The fertility behaviour of the 1960s and later cohorts must be analysed based on the perspective of how often unexpected, unintended, and disappointing events occur for parties who cannot have children even though they want to.

This chapter will estimate the number of pregnancy attempts from the observed number of live births. Birth is a phenomenon that occurs as a result of sexual intercourse or artificial insemination; however, these acts do not always lead to fertility. There should be a considerable number of cases that do not result in a birth due to infertility, spontaneous abortion, induced abortion, stillbirth, etc. There is very little understanding in modern Japanese society as to how many cases that do not result in births exist. This is quite a contrast to the accurate understanding of the number of cases that resulted in birth in the *Vital Statistics* compiled by the Ministry of Health, Labour, and Welfare.

In what follows, a rough estimate for cases that do not result in a birth will be tried, using the knowledge of existing medical and population sciences. Data on maternal age will be used, since the probabilities of infertility and spontaneous abortion vary greatly by age. There have been many studies on this subject, which will utilise in this chapter. As a note, Senda (2011) used data on the number of births per year by mother's age to analyse changes in pregnancy attempts in a cross-sectional term. The analysis in this chapter organises the data in terms of cohort and applies the same method as Senda (2011).

2.5 Pregnancy Attempts

Since birth in modern society occurs as a result of individual decisions, the intention of the parties is extremely important. The intentions for giving birth can be divided into two types. The first is the number of children (quantity) compared to how many (additional) children the parents wish to have. The second is the timing of when to have children. Iwasawa and Mita (2007) analysed the *National Fertility Survey* data, demonstrating the following: (1) the number of women who try to have additional children in their 30s and older is increasing, and (2) the preferred timing varies among these women, because some want children as soon as possible while others want children after a while or do not have any specific idea. Unfortunately, this study did not analyse whether those who wanted children as soon as possible

took any action to make pregnancy possible or, conversely, whether those who did not wish to have children refrained from behaviours that might make them pregnant.

Unlike studies on intention, this study estimates behaviours that are directly related to pregnancy. The term ‘pregnancy attempt’, defined as ‘any intentional action that might lead to pregnancy’ was employed. It typically means having a sexual intercourse without contraception. However, the concept also covers a wider spectrum, including cases involving a passive intention, such as ‘I don’t mind getting pregnant’; more proactive cases in which the individual is thinking ‘I want to have a child as soon as possible’; and cases in which the individual undergoes fertility treatment at obstetrics and gynaecology facilities or uses assisted reproductive technologies, such as in vitro fertilisation. The concept of a ‘pregnancy attempt’ (Basso et al. 2000) is appropriate for representing these behaviours.

Even if an individual does intentionally engage in behaviour that might result in pregnancy, it does not always result in a birth. Cases of pregnancy attempts that do not result in a birth could include: (1) cases in which the woman does not become pregnant (fecundity issue), (2) cases in which the woman becomes pregnant but ends up having a spontaneous abortion or stillbirth, and (3) cases in which the woman voluntarily undergoes induced abortion (Wood 1994). Of these factors, fecundity is known to decline with age. Furthermore, the probability of spontaneous abortion increases with age. Either way, the effect of advancing age on pregnancy is an important factor affecting the gap between pregnancy attempts and births. Heffner (2004) and the Research Group for Women and the Declining Birth Rate (2005) used the data of Andersen et al. (2000) and Menken et al. (1986) to present methods for decomposing these factors. This chapter follows these methods in order to construct estimates regarding pregnancy attempts that did not result in a birth.

Unfortunately, the collected data on induced abortions, infertility, and spontaneous abortions found in the current Japanese statistical system are inadequate. Therefore, this chapter will use available data sources, such as Danish medical statistic data (Andersen et al. 2000) and international research data on natural fertility (Menken et al. 1986). Due to this limitation, my estimation will be very simple and rough.

2.6 Pregnancy Attempts that Do not Result in a Birth

As seen above, the cases of pregnancy attempts that do not result in a birth include the following: (1) induced abortion, (2) stillbirth and spontaneous abortion, and (3) infertility. In the following section, we will examine how frequently these cases occur in contemporary Japan.

2.6.1 *Induced Abortion*

In Japan, the number of induced abortions is published every year by the *Eugenic Protection Statistics*, *Maternal Body Protection Statistics* and the *Report on Public*

Health Administration and Services by MHLW, which aggregates the reports that physicians file with prefectures upon performing an induced abortion.

Here we summarise these statistics according to Senda (2011). In 1955, the statistics included 1,169,079 induced abortions and 1,730,689 births. The ratio was about 2:3. This ratio declined to about 1:3 in 1970, and remained at that level until 1990. Then, it further declined to about 1:5 in 2009 (223,388 induced abortions to 1,070,029 births). Thus, induced abortions in Japanese society dramatically decreased in the past half-century, in terms of both number and ratio (Senda 2011).

That being said, a significant number of induced abortions are still being performed even today. In addition, the ratio of induced abortions to the number of births varies across age groups. The lowest ratio is observed among those in their early 30s, while higher ratios are seen among the younger and older groups. Based on the 2009 data, whereas the ratio for those in their early 30s was about 1:10, it rose to 1:5 and 1:2 for those in their late 30s and those in their 40s, respectively.

Therefore, a considerable number of induced abortions are performed even today, especially within the older age group. For this chapter, which focuses on pregnancy at an older age, induced abortion is a factor that should definitely be taken into account. However, there are probably cases of induced abortions that were performed because the pregnancy was unintended or unwanted, or because there was no choice but to terminate it even though it was attempted.¹ While the latter is a subject of discussion for this chapter, which covers the gap between pregnancy attempts and births, the former is not. However, we cannot distinguish between these two types using the currently available data. Therefore, this chapter will only point out the large number of induced abortions without conducting any further examination.

2.6.2 Stillbirth and Spontaneous Abortion

Next, we will examine those terminations of pregnancy that do not result from artificial treatment. *Vital Statistics* aggregates non-artificial pregnancy terminations that occur at the 12th week of pregnancy or later as ‘natural stillbirth’. The number of natural stillbirths is about 1 % of the number of births. When looking at this by age, although the figure increases among those in their late 40s, it still remains at about 5 % (Senda 2011). Therefore, it will not have a significant impact, even if we ignore the cases that fall under this category.

In contrast, it is believed that there is a very large number of so-called ‘early abortions’, which refer to a termination of pregnancy at less than 12 weeks of pregnancy (Suzumori 2004: 318). However, these cases are not captured in the *Vital Statistics* or in any clinical database in Japan. It is therefore difficult to obtain accurate data.

¹Pregnancy in old age increases the probability of chromosome abnormality. It seems that there are many cases in which an induced abortion is chosen for this reason, because the technologies to prenatally predict and diagnose such cases have advanced in recent years (Yoshimizu 2006).

The *National Fertility Survey*, published by the National Institute of Population and Social Security Research (IPSS), provides a clue for solving this issue. It includes a question that asks about recipients' experiences, including spontaneous abortion, that relate to the subject's history of pregnancy and childbirth (Sato and Iwasawa 1998). Table 2.1 shows the results tabulated from the *14th National Fertility Survey* in 2010 on up to five pregnancies experienced by the women recipients (IPSS 2012: 131–134). The survey did not differentiate stillbirths and spontaneous abortions; these are shown together under the category of 'stillbirth and spontaneous abortion' in Table 2.1. As mentioned above, the majority of incidents in this category might consist of spontaneous abortions during early pregnancy.

We can see from Table 2.1 that the probability of a stillbirth or spontaneous abortion increases as the age at the time of pregnancy increases. The ratio of the number of stillbirths and spontaneous abortions to the number of live births (a/b) found in the right column of Table 2.1 is below 1:9 among pregnancies for all of the ages up to around 30. In comparison, the ratio for pregnancies in the mid-30s is about 1:5, and increases to more than 1:3 for pregnancies among women in their late 30s or later.

However, this data could have a large margin of error. The number of responses from pregnant women 35 or older is small. The sampling error might therefore large. Furthermore, another possible source of error is the bias stemming from the possibility that past negative experiences are less likely to be reported because

Table 2.1 Frequency of stillbirths and spontaneous abortions by women's history of pregnancy and childbirth

Age at pregnancy	Live birth (b)	Stillbirth and spontaneous abortion (a)	a/b
–14	0	0	–
15–18	78	6	0.077
19–20	307	26	0.085
21–22	622	47	0.076
23–24	1267	99	0.078
25–26	1826	190	0.104
27–28	2130	220	0.103
29–30	1870	204	0.109
31–32	1322	182	0.138
33–34	867	141	0.163
35–36	433	81	0.187
37–38	198	61	0.308
39–40	59	37	0.627
41–42	18	8	0.444
43–44	3	5	1.667
Unknown	222	73	0.329

Data The 2010 *14th National Fertility Survey* questionnaire for couples (IPSS 2012: 214–218). The total figures for the first to fifth pregnancies are based on the question on pregnancy experience (Q12). The responses to 'birth and spontaneous abortion (including stillbirth) regarding your pregnancy' are tabulated

the survey uses a distributed and self-administered questionnaire to ask women to answer retrospectively about their pregnancy and childbirth history.

Therefore, in order to find more reliable data for estimating the probability of incidences such as spontaneous abortion, The Danish data provided in Andersen et al. (2000), which used the civil registration system in Denmark, will be used. Andersen et al. (2000) collected data on all pregnancy results between 1978 and 1992 by using personal identification to merge the data that hospitals are required to report—such as stillbirths, spontaneous abortions, and induced abortions—with data on a woman’s history of childbirth. The data on stillbirths and spontaneous abortions are from the National Discharge Registry, which was created based on the hospitals’ diagnoses.

Supposing that there are not many social or cultural factors related to the causes of spontaneous abortions in Japan, the probability of spontaneous abortion at each age should not differ much. To be sure, this point is different from the situation in Japan, since women in Denmark can terminate pregnancy up to the 12th week of pregnancy at public hospitals, free of charge, for any reason whatsoever (Knudsen 1999). In addition, since the number of spontaneous abortions is counted based on the definition ‘it is a termination prior to the 29th week of pregnancy’, this is different from the cut-off for spontaneous abortion in obstetrics in Japan (which occurs at less than 22 weeks of pregnancy). Keeping those differences in mind, we will continue to examine the Danish data.

The number of pregnancies that did not result in a live birth was estimated using the Danish data (Table 2.2). Here I count stillbirths (s), spontaneous abortions (a), and ectopic pregnancies (e). The ratio was calculated against the number of live births (b), as shown in the $(a + e + s)/b$ column in Table 2.2.

Table 2.2 Number of stillbirths and spontaneous abortions by the age of women based on the Danish data (1978–1992)

Age	Live birth (b)	Spontaneous abortion (a)	Ectopic pregnancy (e)	Stillbirth (s)	Total (p)	$(a + e + s)/b$	$(a + s)/b$	b/p
12–19	44,674	5427	808	223	51,132	0.145	0.126	0.874
20–24	246,038	24,465	4163	1046	275,712	0.121	0.104	0.892
25–29	312,904	33,728	7233	1270	355,135	0.135	0.112	0.881
30–34	157,457	22,391	5861	699	186,408	0.184	0.147	0.845
35–39	43,471	11,369	2679	226	57,745	0.328	0.267	0.753
40–44	5101	3962	614	34	9711	0.904	0.783	0.525
45–	117	509	54	1	681	4.821	4.359	0.172
Total of pregnancies	809,762	101,851	21,412	3499	936,524	0.157	0.130	0.865
Total of persons	509,867	85,838	18,968	3457	618,130	0.212	0.175	0.825

Source Civil Registration System; National Discharge Registry (Andersen et al. 2000: 1709) Hydatidiform moles and deliveries of stillborn child that are less than 29 weeks are considered spontaneous abortions. Those that occur afterwards are considered stillbirths

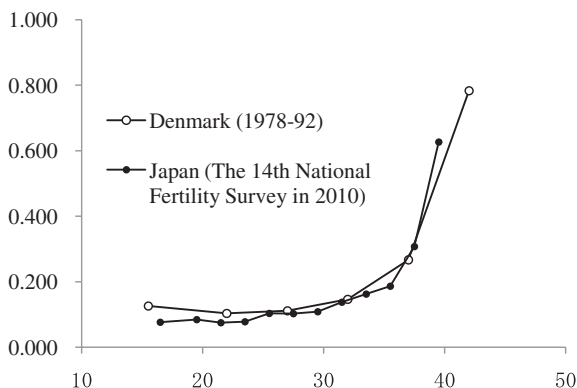


Fig. 2.2 Incident rate of stillbirths and spontaneous abortions by women's age. The values for Japan were calculated as a/b from Table 2.1, while the figures for Denmark were calculated by $(a + s)/b$ from Table 2.2. The horizontal axis shows the midpoint for each age classification (the Danish data for those 45 or older and Japanese data for those 41 or older are excluded)

Although the ratio between the number of births and the number of spontaneous abortions is about 1:10 among those in their early 20s, it increases as age increases; we can see that it reaches 1:3 and 9:10 in their late 30s and early 40s, respectively. Andersen et al. (2000) checked the effects of such factors as the woman's birth cohort, the calendar year of pregnancy, and whether the woman is multiparous. They found that these factors do affect the risk for spontaneous abortion, but the differences due to these factors are within a few percent of each other. They accordingly concluded that the patterns of the ratio of spontaneous abortion by age are the same when the effects of these factors are controlled.

Figure 2.2 compares the data on stillbirth and spontaneous abortion in Japan (Table 2.1) and Denmark (Table 2.2). Since the *National Fertility Survey* in Japan allows for the respondent to determine what spontaneous abortion is, it is possible that ectopic pregnancy is not regarded as spontaneous abortion (or not recognised as pregnancy). Therefore, when preparing Fig. 2.2, I calculated $(a + s)/b$ by excluding ectopic pregnancy from the data for Denmark. The patterns by age are similar in both Japan and Denmark. Although there are small differences (the line for the Japanese data is slightly below that of Denmark), it seems fine to assume that the basic pattern of stillbirth and spontaneous abortion by age is also similar between Japan and Denmark.

2.6.3 Infertility

In addition to stillbirths, induced abortions, and spontaneous abortions, infertility is also a factor that can result in pregnancy attempts that do not lead to a birth.

The Japan Society of Obstetrics and Gynaecology (JSOG 2008: 276) defines ‘infertility’ or ‘sterility’ as ‘a case in which the male and female in their reproductive years do not become pregnant even though they wish to and stay sexually active without contraception for a period of time’. Although it is said that about 10 % of all married couples are infertile (Hoshi 2004), there is no scientific evidence for this figure (Senba 2003: 76), or any reliable statistics. The number of patients being treated at hospitals for infertility is only partially tracked, and it is also not clear as to how many infertile individuals do not go to the hospital (Oishi 2007). Therefore, it is difficult to know the exact number of infertility incidences.

The probability of infertility increases in old age (Wood 1994: 37). Therefore, incidences of infertility are important data when dealing with a decline in fertility due to a delayed reproduction process. However, we are not concerned with an understanding of the incidence of infertility itself. All that is necessary is the ability to estimate the overall number of pregnancy attempts that do not result in a birth while taking infertility and all other factors into consideration.

As described above, the main reasons for pregnancy attempts that do not result in births are infertility and spontaneous abortion, if induced abortion is not considered. Meanwhile, of the cases that do not result in a birth even though the egg is fertilised, only those cases of confirmed pregnancy are recognised as spontaneous abortion. Infertility probably includes cases in which the woman is actually pregnant but not clinically confirmed (Ozawa et al. 2010). If you think of it this way, it is not meaningful to try to distinguish between infertility and spontaneous abortion. As described below, the number of pregnancy attempts that do not result in births will be directly estimated, including both of infertility and spontaneous abortion.

2.7 Estimating Pregnancy Attempts

In what follows, the research results of Menken et al. (1986) will be referred to, which applied the research data on natural fertility produced by Henry (1961) in order to estimate the number of pregnancy attempts that do not result in a birth. Their study provides an estimated effect of couples’ ages on fertility for a population of couples who are not consciously controlling for their number of children (Menken and Larsen 1986). The study results report that, although the overall level of fertility is quite different among populations, the effect of a woman’s age can be observed across the board. Using the early 20s as the baseline, fertility declines by 6 % for women in their late 20s, 14 % for those in their early 30s, 31 % in their late 30s, 64 % in their early 40s, and 95 % in their late 40s (Menken and Larsen 1986: 152; Menken et al. 1986: 1389). Please note that, although the age of men might also determine fertility (De La Rochebrochard and Thonneau 2002; Dunson et al. 2002), only the age of women will be addressed in the discussion below.

Using these values and the number of births, how many pregnancy attempts exist by cohort during the reproduction process will be calculated, as shown in Fig. 2.1. In the following estimate, I assumed that infertility is not present

(i.e., there is only the risk of spontaneous abortion) in the baseline population (those in their early 20s). In other words, the probability that a pregnancy attempt will result in a birth for those in their early 20s is set at 0.892, based on the value in the far right column b/p of Table 2.2. Likewise, the probability that the pregnancy attempt will result in a birth among those in their teens is 0.874, assuming that they only face the risk of spontaneous abortion. For those in their late 20s, I assumed a 6 % decline from the baseline, in accordance with Menken and Larsen (1986) and set it as $0.892 \times 0.94 = 0.838$. Those in their 30s and 40s were handled in a similar way: the birth rate for those in their early 30s is $0.892 \times 0.86 = 0.767$, for those in their late 30s it is $0.892 \times 0.69 = 0.615$, for the early 40s it is $0.892 \times 0.36 = 0.321$, and for the late 40s it is $0.892 \times 0.05 = 0.045$. For women age 50 or older, I assume the rate is the same as for those in their late 40s, 0.045. Although the data on the number of births is available in one-year increments, I grouped them in five-year increments to estimate the number of pregnancy attempts using the above theoretical ratio. The estimated results are shown in Fig. 2.3.

The data for those in their 20s do not differ so much from those presented in Fig. 2.1. In other words, the 1953 cohort reaches its highest peak when its members are in their late 20s. The number of births gradually declines for subsequent cohorts. In the past, many pregnancy attempts took place while women were still quite young, in their 20s. Since there is hardly any infertility or spontaneous abortion present in this age group, the fertility rate reached a high level (the probability of pregnancy attempts resulting in a birth was high). However, this number had significantly dropped in the 1963 cohort and has continued falling since then.

Regarding the birth rate for those in their 30s, there is no significant difference between Figs. 2.1 and 2.3, at least up to the 1960s cohort. For these cohorts, the number of pregnancy attempts sharply declined when women reach their 30s, regardless

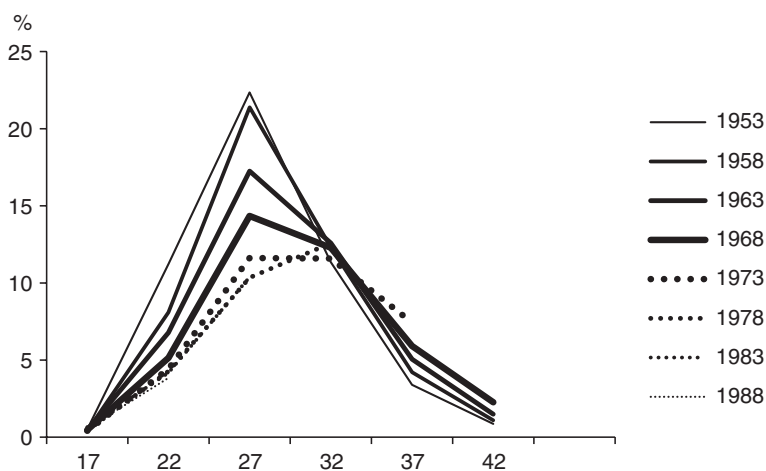


Fig. 2.3 Pregnancy attempts by birth cohort (1953–1988) and age (5-year classification)

of whether they were born in the 1950s or 1960s. Women born in the 1950s, who had attempted pregnancy with a high probability in their mid-20s, completed their reproduction process while in their 20s and demonstrate a low pregnancy rate in their 30s. Meanwhile, with those who were born in the 1960s, reproductive activity in their 30s is as inactive as for those born in the 1950s. The women in the 1960s cohort, whose pregnancy attempts were infrequent in their 20s, did not catch up in their 30s.

The cohorts from the 1970s and later demonstrate a different trend. Although the number of pregnancy attempts is even smaller for women in their 20s in the 1973 cohort, when compared to the 1968 cohort, it does not decline too much for women in their early 30s, and is maintained at a certain level even into their late 30s. With the 1978 cohort, the number of pregnancy attempts is actually higher for women in their early 30s than for those in their late 20s. In this way, those women who were born in the 1970s or later were liberated from the traditional pattern, in which pregnancy attempts dramatically fall once they reach their 30s. Women in the 1970s cohort tried to have children after they reached their 30s. However, whether they face challenges in having those children is another problem.

2.8 Changes in Social Life-Cycle and the Cohort Effect

It is plausible to say that the changes in the reproduction process among the 1950s, 1960s, and 1970s cohorts that are examined in this chapter represent the process through which Japan became a low-fertility society. This process keeps pace with changes in the social life-cycle.²

Refer to Figs. 2.4, 2.5, 2.6, 2.7, 2.8, 2.9 and 2.10, the cumulative frequency of births and estimated birth attempts in each cohort, respectively. Between 1953 and 1958 (Figs. 2.4 and 2.5), the curve for the cumulative frequency of births sharply rises for ages 24–29, slows down for 29–34, and remains at the same level for ages 34 and older.

Between 1963 and 1968 (Figs. 2.6 and 2.7), the sharp increase previously seen for ages 24–29 disappears, as more people remain unmarried at these ages. The frequency of births also declines. The curve of the cumulative frequency remains at the same level for the cohorts for age 34 and older.

The curve for the 1973 cohort reveals a new pattern (Fig. 2.8). An increase continues even to ages 34–39, while the rise becomes shallower than for the earlier years, during ages 24–34. Regarding the 1978 and 1983 cohorts (Figs. 2.9 and 2.10), there are not enough data at this time. However, they seem to show a similar tendency to the 1973 cohort. For the women in the 1970s cohort, the delay in the timing of pregnancy attempts brought about an increase of pregnancies in their late-30s. Note that the area between the lines for ‘Attempt’ and ‘Birth’ represents the cumulative gap between attempts and outcomes. Its size depends on the timing of the pregnancy attempts. The later the attempt, the larger this area is.

²The ‘social life-cycle’ is marked by life events such as ‘changes in marital, job, and economic status index’ (Scheid and Brown 2009).

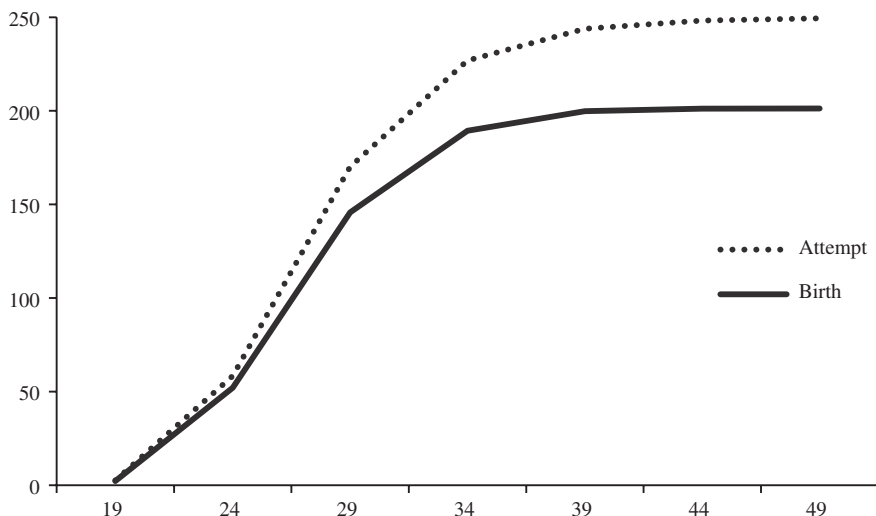


Fig. 2.4 Cumulative frequency of births and estimated birth attempts: 1953

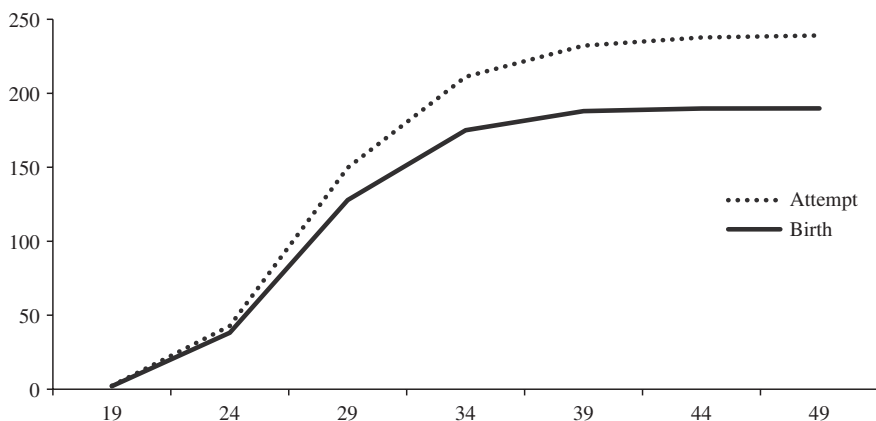


Fig. 2.5 Cumulative frequency of births and estimated birth attempts: 1958

The life course in which a woman marries and has children in her mid-20s was well established within the 1950s cohort. The reproduction process was compressed into the women's 20s; it was a common lifestyle to marry early in life and have, on average, two children.

The subsequent 1960s cohort experienced the collapse of the social life-cycle in which a woman married and had children during her 20s. Late marriages and marriage decline continued, and the choice to not marry rapidly became common in this cohort. Even if they did marry, the timing gradually shifted to later in their lives. However, the normative life-cycle, in which a woman finished having

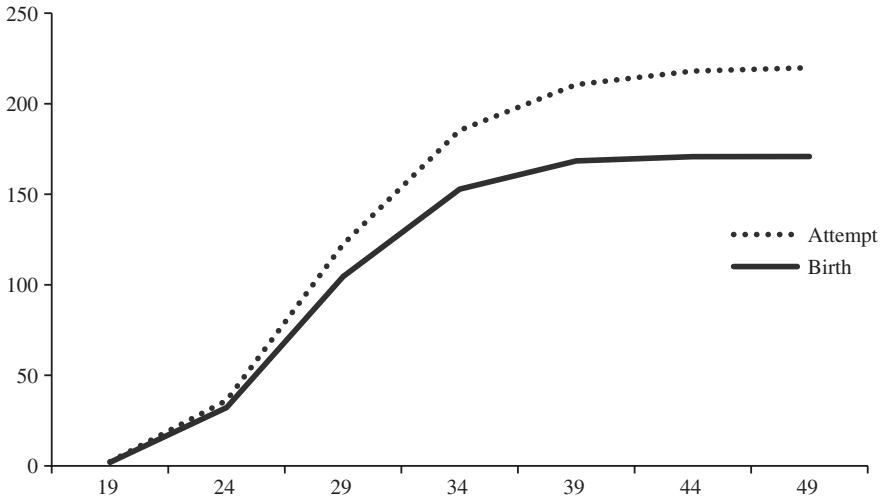


Fig. 2.6 Cumulative frequency of births and estimated birth attempts: 1963

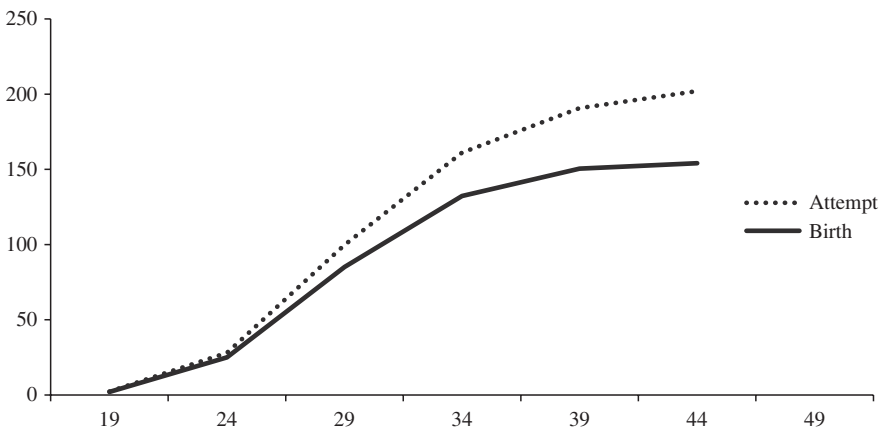


Fig. 2.7 Cumulative frequency of births and estimated birth attempts: 1968

children while in her 20s, was maintained by this cohort. Referring to Figs. 2.6 and 2.7, pregnancy attempts for the 1960s cohort were concentrated among women in their 20s, and rapidly decreased as they reached their 30s. They never recovered from the delay in the birth process in their 20s after reaching their 30s.

In contrast, women in the 1970s cohort clearly transformed the social life-cycle during their 30s. As can be seen in Fig. 2.8, the reproduction process is no longer an activity limited to one's 20s. The data in this figure exhibit the emergence of a new social life-cycle, in which women have children in their late 30s. Pregnancy has actually become something that is actively attempted after a woman reaches her 30s.

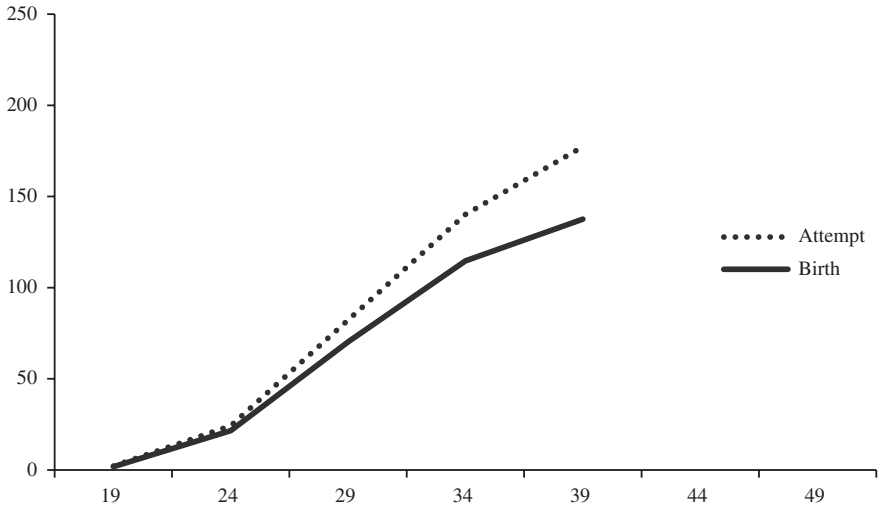


Fig. 2.8 Cumulative frequency of births and estimated birth attempts: 1973

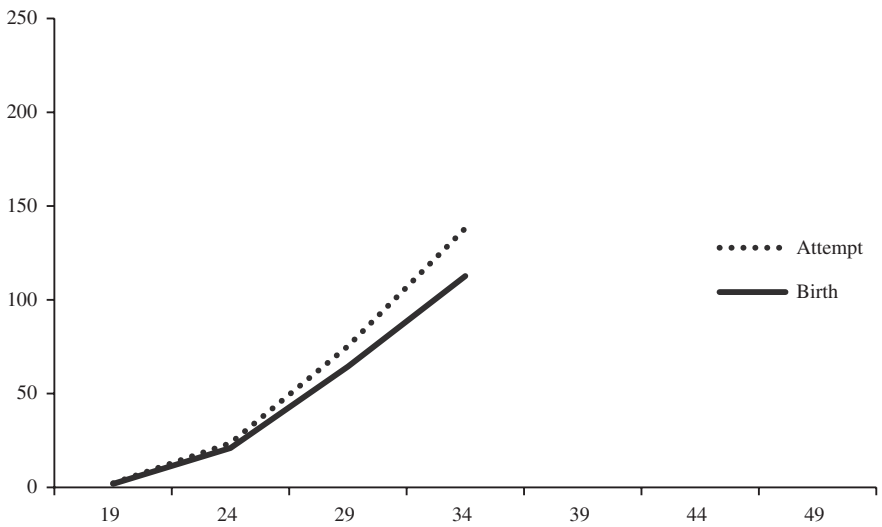


Fig. 2.9 Cumulative frequency of births and estimated birth attempts: 1978

Note that there is some uncertainty present in the data for the 1970s and subsequent cohorts, since they are in their 40s, or younger, and have therefore not yet completed their reproduction process. So, the final conclusion cannot be known until some time passes. However, if the current trend continues in its current state, we can expect the timing of the reproduction period to shift further into old age.

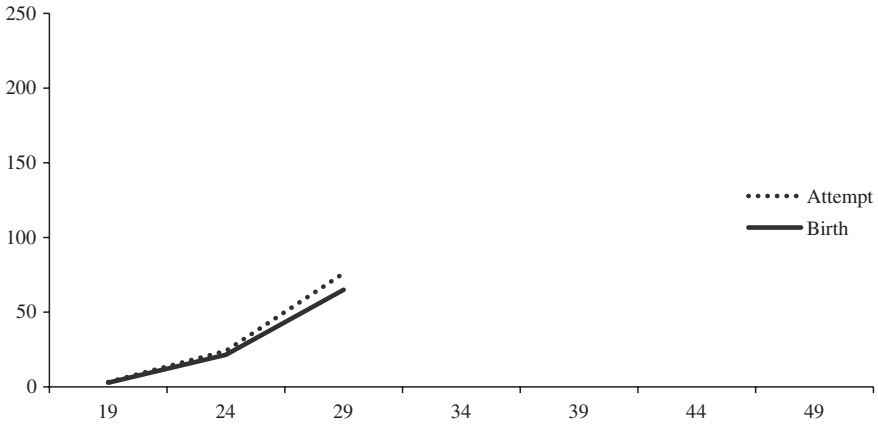


Fig. 2.10 Cumulative frequency of births and estimated birth attempts: 1983

The primary period for the reproductive process is expected to shift from a woman's 20s to late-30s or later among the younger cohorts of the future.³

On the other hand, the possibility of pregnancy and childbirth is determined by the biological reproductive period. It is not possible for a woman to have children, even if she wanted to, if her body is not in a condition suitable to making it possible. The period in which a woman can become pregnant and give birth has not been extended too much today, even with advanced medicine.

For this reason, pregnancy attempts that do not result in a birth will increase when a woman's social life-cycle is pushed back due to changing social conditions. If a woman attempts to become pregnant in her mid-20s, she would have about ten years before she reaches her mid-30s, when her fecundity significantly drops and the probability for spontaneous abortion increases. It is probably quite feasible to have two to three children in this period. Because of the strong norm of universal and timely marriage, this type of life course had been maintained as a standard through the 1950s cohort. Today, however, this social life-cycle has shifted to later in life. Among the 1970s and later cohorts, the probability for successfully giving birth has already decreased by the time the majority of women begin attempting pregnancy in their 30s. Even if a woman wished to have three children, it is quite impossible that she will accomplish it by her biological time limit. Indeed, Senda (2014) estimated that 29.5 % of pregnancy attempts in 2012 did not result in live birth, a 9-point increase from the 1985 figure of 20.4 % (Table 2.3).

³Billari et al. (2011) analysed surveys conducted in 25 European countries and noted that the responses to the question for the age at which a woman cannot bear a child tend to be 35, 40, 45, and 50 years old. Among them, the vast majority answered '40 years old', accounting for 40 %. This probably has to do with the fact that people tend to plan their life in five-year increments. This is important in terms of the issues regarding formation and change in social life-cycles.

Table 2.3 Trend of the estimated pregnancy attempts that do not result in births

	1955	1985	2012
Pregnancy attempts	2,229,874	1,792,413	1,468,756
Pregnancy attempts that do not result in births	499,185	360,874	431,661
Percentage of the pregnancy attempts that do not result in births (%)	22.4	20.1	29.4

This trend continues today. The Ministry of Health, Labour and Welfare also reported age-specific fertility for women in their 30s has increased, while for women in their 20s it has decreased, with the total for all ages (TFR) having slightly increased since 2006 (MLHW 2015). In recent years, looking for a marriage partner (*kon-katsu*) and methods to improve the chance of becoming pregnant (*nin-katsu*) have attracted social attention (Saito and Shirakawa 2012). However, unless there is a ground-breaking advancement in medicine that overcomes the biological limit, the number of births among those in their late 30s and older is unlikely to increase dramatically (Balasch and Gratacós 2012).

The 1960s cohort was present in the middle stage of this social change. While the number of pregnancy attempts drastically decreased among women in their 20s, it did not increase among women in their 30s. It may be that the decline in pregnancy attempts was due to delays in the timing of when to have children. However, they did not try to return to overall levels by giving birth after reaching their 30s. The 1960s cohort was thus very inactive in terms of reproduction throughout their life course. I can conclude that they ran out of time: they postponed having children in their 20s to account for their delayed social life-cycle, and then gave up childbirth once they passed the age deemed ideal by the norms of their time.

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