The Annual Meeting of the Population Association of America,
New Orleans, LA, April 17-19, 2008

Life Course Prospects from the Official Population Projections for Japan: The Longest Life with the Lowest Fertility*

Ryuichi Kaneko**

Abstract

In this study, life course prospects of Japanese women are estimated from the official population projection by means of multistate life table method. First, I briefly discuss on the results and methods of new round of the Projections released in December, 2006. They provide various information on current situation and future development of vital events, i.e. marriage, birth and death, as assumptions, as well as a sketch of expected demographic changes over a next 50 years. Then I present and examine the estimated measures for the projected life of women derived from the multistate life tables of projected population. Average life time spent in never married status increases to 42.5 years (or 47% of the life expectancy) in cohort born in 1990 from 25.3 years (31%) in those born in 1950. Life time probability of childlessness and having no grandchild are 38.1% and 50.2% respectively in cohort born in 1990.

Extended Abstract

Introduction

In this paper, first I discuss on the results and methods of new round of the official Population Projections for Japan released in December, 2006. They provided a sketch of expected demographic changes over a 50 year period from 2006 up to 2055, indicating persuasive view that a substantial population decline with unprecedented population aging was an unavoidable part of the future of the society. The projections are unique not only as those from the world lowest fertility assumptions with the highest life expectancy, but also in their sophisticated life course approach in constructing assumptions on vital rates. In this connection, I attempted to construct the multistate life table for the projected life of Japanese women to obtain their life course measures mainly by ultimate family status. The measures include life time probability of never marrying, childless, having no grandchild and so on. The

---

* This is a draft of paper to be presented to the Annual Meeting of the Population Association of America, 2008 (New Orleans, LA, April 17-19, 2008).

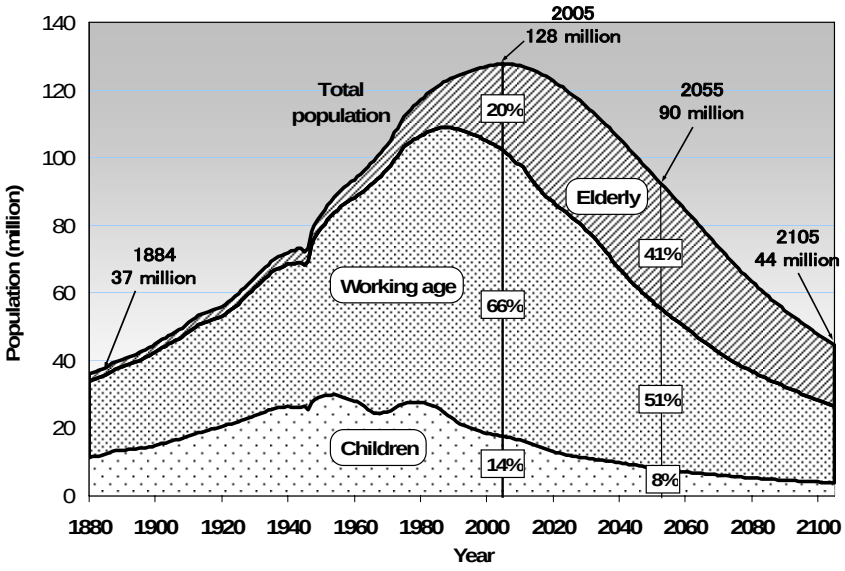
** National Institute of Population and Social Security Research, Hibiya-kokusai Bldg. 6F, 2-2-3, Uchisaiwai-cho, Chiyoda-ku, Tokyo 100-0011, Japan. email: r-kaneko@ipss.go.jp

probabilities incorporate incidences from premature death before the events. Average life time spent in each family status such as never married state, childless state, and only-child state, are also examined. For example, the life time probability of childlessness and having no grandchild are 38.1% and 50.2% respectively in cohort born in 1990. They were 18.4% and 22.2% in those born in 1950. Besides, the average life time spent in never married status increases to 42.5 years (or 47% of the life expectancy) in cohort born in 1990 from 25.3 years (31%) in those born in 1950. These changes set off drastic increase of elderly who do not have offspring to live with or rely on in this society of near future.

Population Prospects

Outlines of the projected results are as follows. According to the principal variant[1] (medium fertility variant with medium mortality variant), the population is expected to fall to less than 90 million by 2055; this is a decline of 37.8 million or 30% from the starting population (roughly 127.8 million in 2005). Besides, the whole loss with another 10.7 million takes place in age under 65, and the 10.7 million of increase arises, instead, in age 65 and over resulting in the proportion elderly as high as 40.5%, which is twofold of 20.2% in 2005, already the world highest.

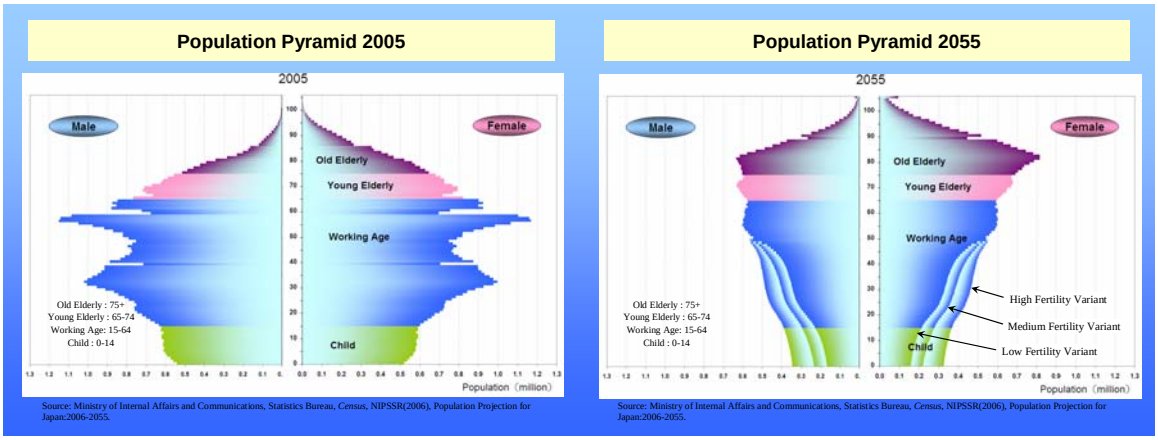
Figure 1. Growth and Reduction of Population of Japan: 1880-2105



Source: Ministry of Internal Affairs and Communications, Statistics Bureau, Census, NIPSSR (2006), Population Projection for Japan:2006-2055 [the medium-fertility and medium-mortality variant].

[1] There are nine variants in the Projections which are combinations of three fertility assumptions, medium, high, and low, with three mortality assumptions, medium, high, and low.

Figure 2. Growth and Reduction of Population of Japan: 1880-2105

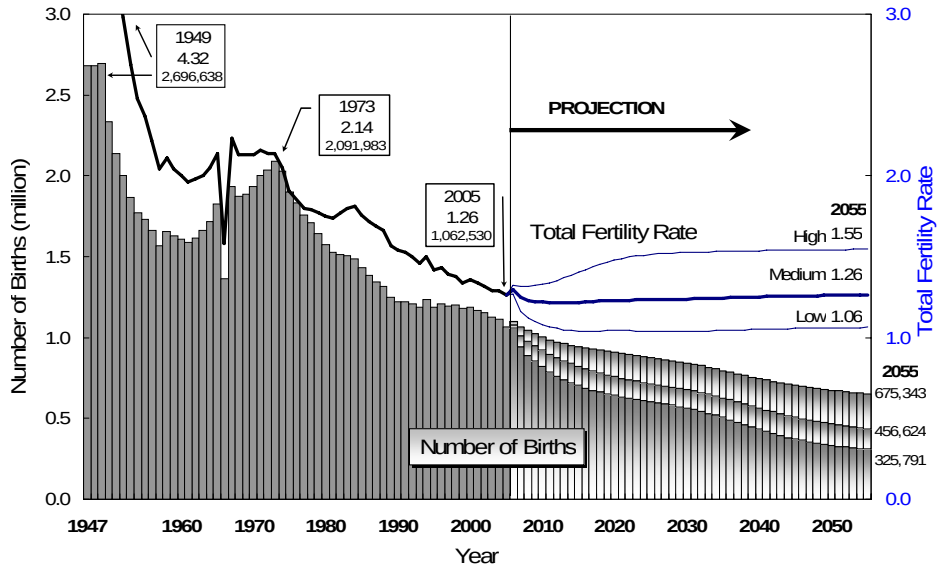


Source: Statistics Bureau, Census 2005, NIPSSR (2006), Population Projection for Japan:2006-2055 (three fertility variants with medium-mortality).

Assumptions

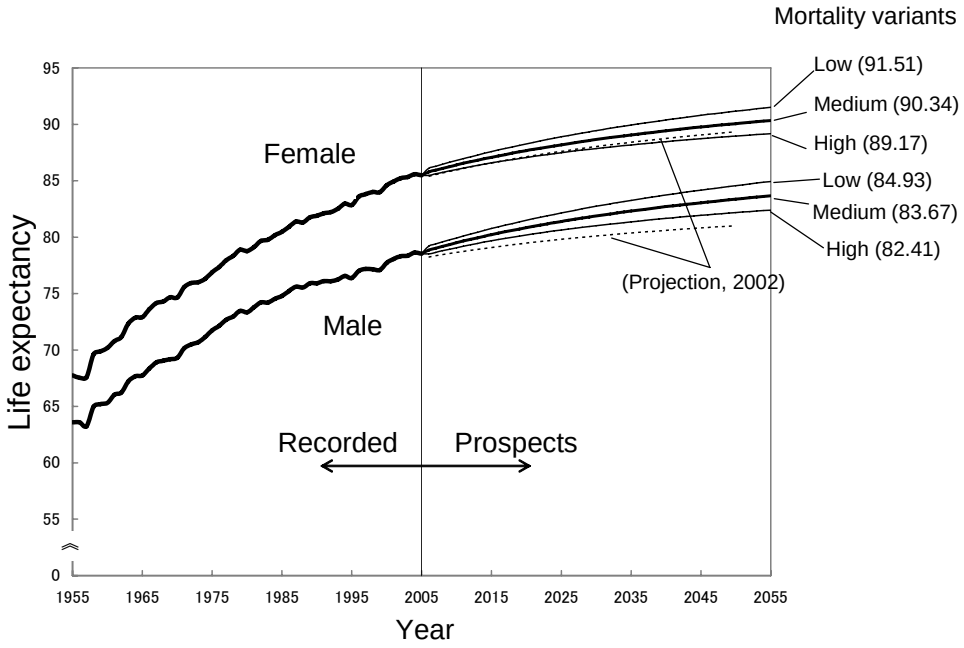
This unprecedented population comes out from assumptions of the lowest fertility combined with the longest life expectancy. The eventual total fertility rate is 1.26 (ranging from 1.06 to 1.55), and the female life expectancy 90.3 (ranging from 89.2 to 91.5). How could it be possible for fertility to remain so low for some 50 years of period? We employed life course approach to construct fertility assumptions.

Figure 3. Number of Births, and Total Fertility Rate in Japan
Trends and Prospects: 1947-2055



Source: Ministry of Health, Labor and Welfare, Vital Statistics. NIPSSR (2006), Population Projection for Japan:2006-2055 (the three fertility variants with medium-mortality assumption).

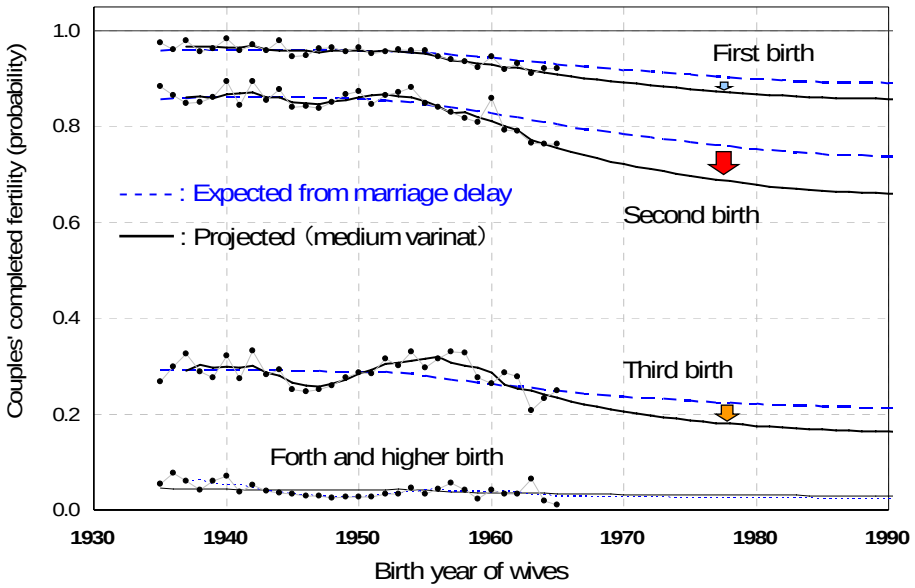
Figure 4. Trends and Prospects of the Life Expectancy: 1955-2055



The future fertility schedules are generated through reconstruction of reproductive life course formed by such behaviors as marriage and marital childbearing. Assumptions are setup with the following four parameters of reproductive behaviours; (i) the mean age at first marriage, (ii) the proportion of never married, (iii) the completed number of births from married women, and (iv) the coefficient of divorce, bereavement and remarriage. Each of the parameters is projected according to trend derived from demographic data compiled for cohorts so that the completed life courses of future generations are assembled. For example, the case of (iii) the completed number of births from married women is demonstrated in Figure 5. The parameters are translated into fertility schedules separately by birth order through demographic model called the Generalized Log-gamma model (an extension of the Coale-McNeil model) with empirical adjustments specific to the country's unique pattern (Kaneko, 2003). The resulted cohort trends of the cumulative fertility rate are shown in Figure 6.

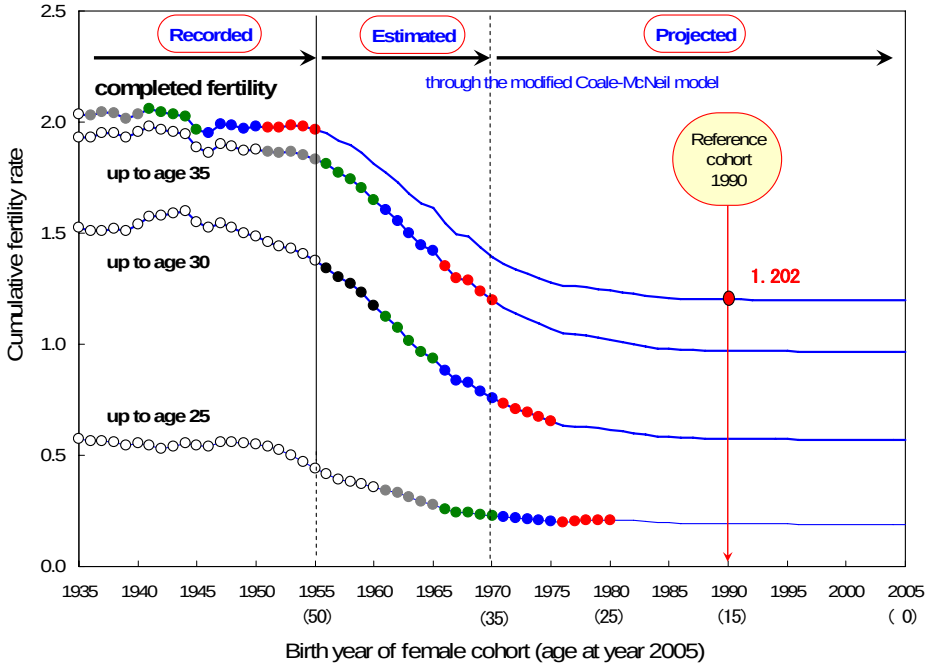
The assumption building through observation and projection of cohort measures of life course components in this set of projections enables us to construct the projected life course in relation to the relevant life events. In fact I constructed the multistate life tables for those projected life mainly by family status. Those are examined in the next section. The results indicate that the less-reproductive and non-familial lives prevail among the young and future generations reflecting rapid transformation of partnerships and family formation pattern observed in the current cohorts.

Figure 5. Expected and Prospective Trends of Couple's Probability Having Birth of Each Order by Wife's Birth Year



Source: NIPSSR (2006), the Thirteenth National Fertility Survey, 2005.

Figure 6. Recorded and Projected Cohort Trends of the Cumulative Fertility Rate at Selected Age: 25, 30, 35, and Completed (Age 50)



Source: NIPSSR (2006), Population Projection for Japan:2006-2055 [the medium-fertility assumption].

Life Course Construction

The life-course construction is characterized approach employed in the projection for Japan since 1990's. It requires a good deal of data and somewhat complicated model system. Series of the census, vital statistics, and micro data from national representative fertility surveys were brought into play in the construction of fertility assumptions. It is often the case with population projection that excessive complications do not contribute to accuracy. However, our experience indicated that it would deserve such intensity in methodology, since it provides detailed information on the way how life of the future would be, which contributes to fulfilling the accountability on preposition of the projections to the public. It also offers many distinct traces to improve the models through monitoring and contrasting the actual drift of the measures with the projected. I briefly discuss the roles, uses, prospects and some limitations of the approach as well.

I attempted to construct the multistate life table for the projected life of Japanese women to obtain their life course measures mainly by ultimate family status. The measures include life time probability of never marrying, childless, having no grandchild and so on. The probabilities incorporate incidences from an untimely death before the events. Average life time spent in each family status such as never married state, childless state, and only-child state, are also examined.

In Table 1, the woman's life time probabilities and distributions by family status for birth cohorts born in 1950 through 1990 are indicated. The cohorts born in 1950 and 1955 had completed their reproductive life processes by the time of projection, thus their figures are regarded as actual records. On the other hand, the cohorts born in 1960 and after have yet completed the processes, and their figures are all for projected life by the assumption based on the trends of relevant parameters, though length of projected period varies by cohort to cohort in relation to their age at projection.

Life time probability of a woman eventually marrying assessed at her birth is 86.4% for one among cohort born in 1950. The figure gradually decreases from a cohort to next until 75.7% for a woman born in 1990. These figures are somewhat lower than those calculated from nuptiality rate among the fertility assumption, since they include effects from premature death before marriage.

The probability of never marrying, childlessness and having no grandchild are 24.3%, 38.1% and 50.2% respectively in cohort born in 1990 (see also Figure 7). If compared with those in preceding cohorts, these figures indicate rapid prevalence of less-reproductive and non-familial life styles toward an unprecedented level in this society.

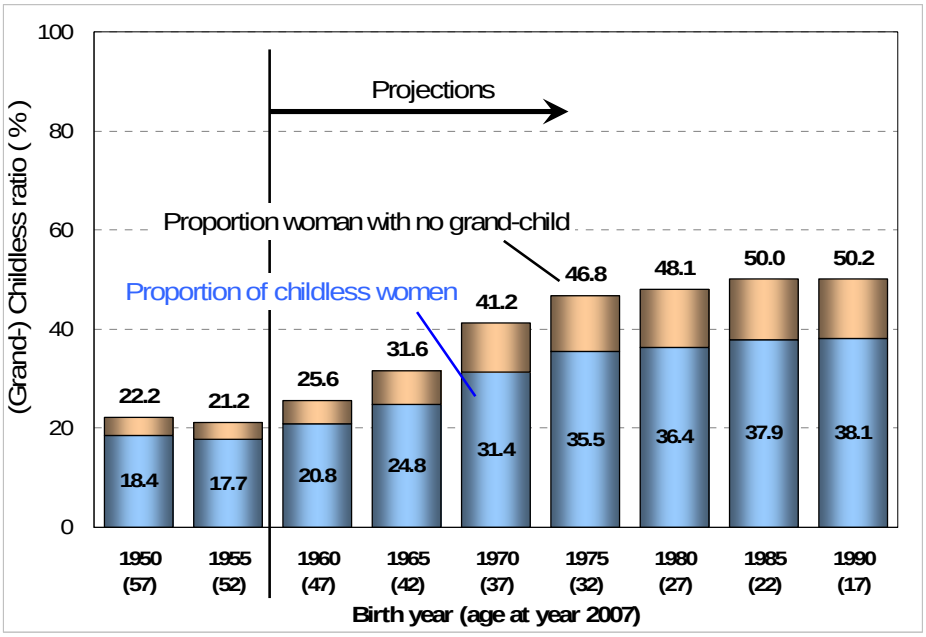
Table 1 Woman's Life Time Probabilities and Distributions by Family Status: Perspectives from the Medium Variant for Cohorts Born in 1950-90

(%)

	Birth year of woman's cohort								
	Recorded		Projected						
	1950	1955	1960	1965	1970	1975	1980	1985	1990
Life time probability of woman … (at birth)									
Marrying	86.4	88.8	87.1	85.6	82.1	78.3	76.4	75.7	75.7
Having 1st birth	81.6	82.3	79.2	75.2	68.6	64.5	63.6	62.1	61.9
Having 2nd birth	70.4	71.1	65.8	58.6	49.8	45.7	44.8	43.9	43.9
Having 3rd birth	23.6	26.7	24.1	19.1	14.7	12.8	11.7	11.3	11.2
Having 4th and higher birth	4.2	4.7	4.5	3.8	3.2	2.7	2.3	2.0	1.9
Never marrying	13.6	11.2	12.9	14.4	17.9	21.7	23.6	24.3	24.3
Childless	18.4	17.7	20.8	24.8	31.4	35.5	36.4	37.9	38.1
Never having 2nd child	29.6	28.9	34.2	41.4	50.2	54.3	55.2	56.1	56.1
Never having 3rd child	76.4	73.3	75.9	80.9	85.3	87.2	88.3	88.7	88.8
Never having 4th child	95.8	95.3	95.5	96.2	96.8	97.3	97.7	98.0	98.1
Life time distribution of woman by number of child (at birth)									
Childless	18.4	17.7	20.8	24.8	31.4	35.5	36.4	37.9	38.1
Never married	13.6	11.2	12.9	14.4	17.9	21.7	23.6	24.3	24.3
Ever married	4.8	6.5	7.9	10.5	13.5	13.8	12.8	13.6	13.8
Only child	11.2	11.2	13.3	16.5	18.7	18.8	18.8	18.1	18.0
Two children	46.8	44.4	41.8	39.5	35.2	32.9	33.0	32.6	32.8
Three children	19.4	22.0	19.6	15.3	11.5	10.1	9.4	9.3	9.3
Four and more children	4.2	4.7	4.5	3.8	3.2	2.7	2.3	2.0	1.9
Net Reproduction Rate	87.5	90.0	84.5	76.3	66.3	61.2	59.6	58.1	57.9
No grandchild	22.2	21.2	25.6	31.6	41.2	46.8	48.1	50.0	50.2
Life time proportion of woman (without mortality effect = directly derived from fertility assumption)									
Never married	5.0	5.8	9.3	12.0	16.2	20.4	22.6	23.5	23.5
Childless	10.3	12.7	17.5	22.7	30.0	32.8	35.7	37.1	37.4
No grandchild	12.1	15.0	21.3	28.8	39.3	42.9	46.8	48.9	49.4

Source: From the projection 2006, medium-fertility and medium-mortality variant. The life time proportions of woman never married and childless (without mortality effect) are officially provided numbers. Other numbers are calculated by the author from the assumption. The sex ratio at birth for the net reproduction ratio is officially provided assumption and is 105.4 (fixed value from average over year 2001-05).

Figure 7. Childless and Non-grandchild Ratio among Women by Cohort: The Medium Assumption for Female Cohort born in 1935-1990



Source: From the projection 2006, medium-fertility and medium-mortality variant. Proportions are calculated by the author from the assumption of the projection 2006, medium-fertility and medium-mortality variant.

Average life times spent in certain family status for female cohorts born in 1950-90 are presented in Table 2, with their proportion in the life expectancies. For instance, the average life time spent in never married status increases to 42.5 years (or 47% of the life expectancy) in cohort born in 1990 from 25.3 years (31%) in those born in 1950. Figure 8 illustrates that amount of life spent in never married state will drastically increase for Japanese women of young generations.

Table 2 Woman's Average Life Time Length of Period Spent in Each Family Status: Perspectives from the Medium Variant for Cohorts Born in 1950-90

(year)

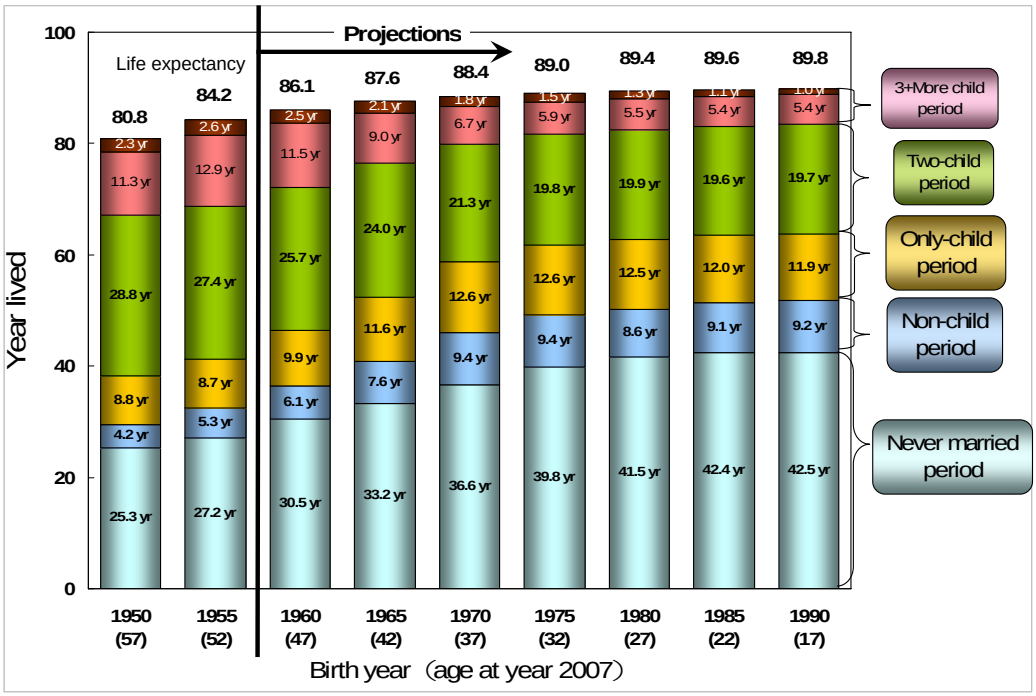
	Birth year of woman's cohort								
	Observed		Projected						
	1950	1955	1960	1965	1970	1975	1980	1985	1990
Average life time length of period spent in each family status									
Life expectancy	80.8	84.2	86.1	87.6	88.4	89.0	89.4	89.6	89.8
Never married	25.3	27.2	30.5	33.2	36.6	39.8	41.5	42.4	42.5
Childless	29.5	32.5	36.5	40.9	46.0	49.2	50.2	51.4	51.7
Never had 2nd child	38.3	41.2	46.4	52.5	58.7	61.8	62.7	63.5	63.7
Never had 3rd child	67.1	68.7	72.1	76.5	79.9	81.6	82.6	83.1	83.4
Never had 4th child	78.5	81.5	83.6	85.5	86.7	87.5	88.1	88.5	88.8
Ever married	55.4	57.0	55.6	54.3	51.8	49.2	47.8	47.3	47.3
Having Child(ren)	51.2	51.7	49.6	46.7	42.4	39.8	39.2	38.2	38.1

(%)

Proportion of life time spent in each family status									
Life expectancy	100	100	100	100	100	100	100	100	100
Never married	31	32	35	38	41	45	46	47	47
Childless	37	39	42	47	52	55	56	57	58
Never had 2nd child	47	49	54	60	66	69	70	71	71
Never had 3rd child	83	82	84	87	90	92	92	93	93
Never had 4th child	97	97	97	98	98	98	99	99	99
Ever married	69	68	65	62	59	55	54	53	53
Having Child(ren)	63	61	58	53	48	45	44	43	42

Source: From the assumption of the projection 2006, medium-fertility and medium-mortality variant. The life expectancies are officially provided numbers. Other numbers are calculated by the author

Figure 8. Woman's Average Life Span and It's Composition by Family Status for Birth Cohorts born in 1950-1990



Source: From the projection 2006, medium-fertility and medium-mortality variant. The life expectancies are officially provided numbers. Other numbers are calculated by the author from the assumption.

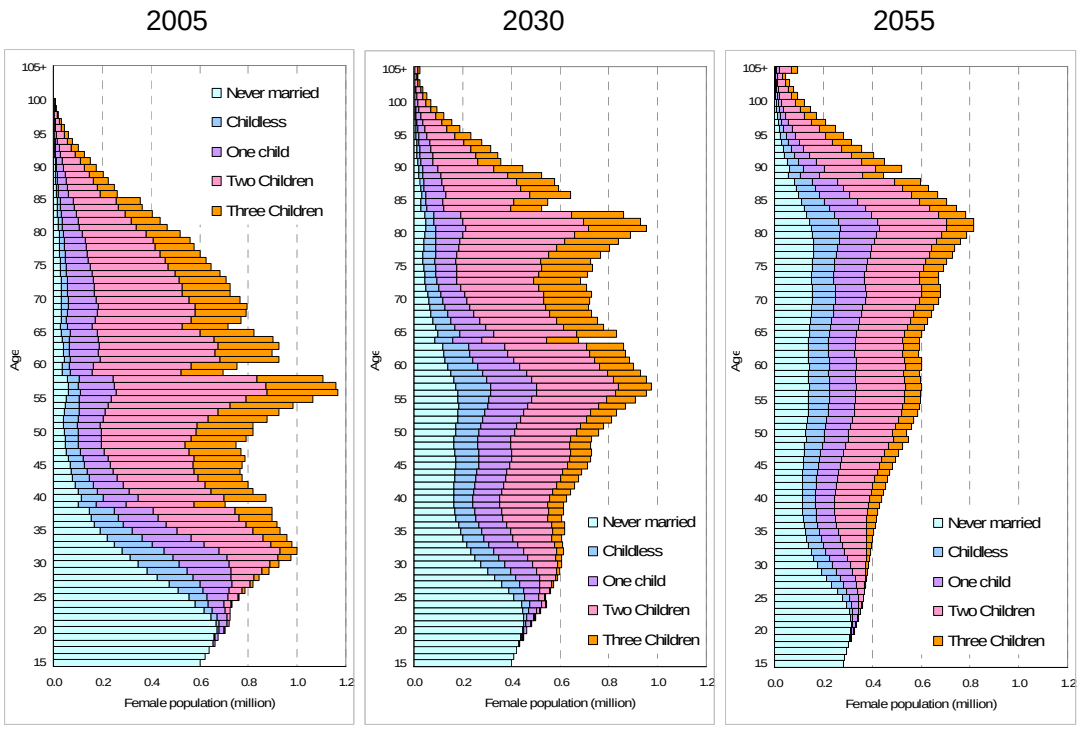
The changes in woman's life course cause tectonic movements in population composition as well. In Table 3 and Figure 9, I indicated the composition of female population by family status at three chronological time, year 2005, 2030, and 2055. They give us a persuasive view that these life course changes seen above set off the drastic increase of elderly who do not have offspring to live with or rely on in this society of near future. 30.9% of women age 65 and higher do not have child in 2055, while the figure is 8.0% in 2005. Although I indicated the situation only for women, the view should be expanded over the whole nation.

Table 3 Composition of Woman in Each Age Group by Family Status:
Perspectives from the Medium Variant in Year 2005, 2030, and 2055

Age Group	2005			2030			2055		
	Proportion of woman …								(%)
	Never married	Childless	Less than two children	Never married	Childless	Less than two children	Never married	Childless	Less than two children
15-19	99.2	99.3	99.9	99.2	99.4	99.9	99.2	99.4	99.9
20-24	88.4	91.9	97.9	89.2	92.6	98.1	89.3	92.6	98.1
25-29	57.5	72.4	88.6	62.6	75.2	89.3	62.8	75.3	89.4
30-34	29.3	46.1	68.1	38.5	54.0	73.4	38.5	53.9	73.4
35-39	17.6	30.0	48.5	28.6	41.9	60.3	28.7	41.9	60.3
40-44	11.4	20.7	36.1	25.1	37.9	55.9	25.1	37.9	56.1
45-49	7.3	14.6	27.4	23.3	36.5	55.1	23.9	37.5	55.7
50-54	5.0	11.5	23.3	21.9	35.0	54.1	23.6	37.5	55.7
55-59	5.2	9.6	22.2	17.9	32.2	51.7	23.6	37.5	55.7
60-64	4.6	7.5	20.7	14.3	26.8	44.8	23.5	37.4	55.6
65-69	4.1	7.7	22.4	10.7	20.4	35.8	23.5	37.4	55.6
70-74	4.4	8.1	23.1	7.2	14.6	27.4	22.9	36.5	55.1
75-79	4.4	8.1	23.1	5.0	11.5	23.3	21.9	35.0	54.1
80-84	4.4	8.1	23.1	5.2	9.6	22.2	17.9	32.2	51.7
85-89	4.4	8.1	23.1	4.6	7.5	20.7	14.3	26.9	45.0
90-94	4.4	8.1	23.1	4.1	7.7	22.3	10.8	20.6	36.1
95-99	4.4	8.1	23.1	4.4	8.1	23.1	7.4	14.9	27.9
100+	4.4	8.1	23.1	4.4	8.1	23.1	5.1	11.3	23.2
15+	22.8	29.8	43.6	24.8	34.3	49.4	28.9	41.2	58.1
15-49	41.6	51.4	65.3	48.0	58.9	73.4	48.2	59.0	73.4
65+	4.3	8.0	22.9	6.3	12.2	25.6	18.2	30.9	48.8

Source: From the projection 2006, medium-fertility and medium-mortality variant. Numbers are calculated by the author

Figure 9. Composition of Female Population by Family Status:
Perspectives from the Medium Variant in Year 2005, 2030, and 2055



Source: From the projection 2006, medium-fertility and medium-mortality variant. Numbers are calculated by the author

Discussion

In this paper, I attempted to construct the multistate life table for the projected life of Japanese women to obtain their life course prospects mainly by ultimate family status. The measures include life time probabilities and average portion of life times in relation to family status such as marital and parity states.

The results indicated that the less-reproductive and non-familial lives prevail among the young and future generations reflecting rapid transformation of partnerships and family formation pattern observed in the current cohorts. These life course changes then lead to the drastic increase of elderly who do not have offspring to live with or rely on in this society of the near future, which suggests need for fundamental reforms in economic and social institutions on which the elderly subsist.

These are findings translated from the official population projection by means of life course type assumptions and multistate life table techniques. It is apparent that the combination provides good amount of information on future society not only from the view of aggregate at population level but also from the individual perspectives.

References

Kaneko, Ryuichi, 2003, “Elaboration of the Coale-McNeil Nuptiality Model as the Generalized Log Gamma Distribution: A New Identity and Empirical Enhancements,” *Demographic Research*, Vol. 9-10:223-262. http://www.demographic-research.org/

National Institute of Population and Social Security Research (NIPSSR), 2007. *Nihon no Syorai Suikei Jinko* (*Population Projection for Japan: 2006-2055*), Tokyo: Kosei Tokei Kyokai.