

34. Projections can be used not only for pension reforms, health and education planning, etc., but also to highlight the possibilities of intervention on the demographic developments. Background studies on the demographic drivers may therefore also be interesting for policy-makers.

35. The collaboration with experts from other fields is a relevant element to increase the impact of demographic analysis and projections. Taking into explicit consideration socio-economic factors affecting demographic developments will contribute to the comprehension of the messages from demographers and will likely improve the performance of the models.

### **III. Publication of the proceedings**

36. Eurostat will take the responsibility for publishing the proceedings of the meeting.

### **IV. Recommendations for future work**

37. The meeting was informed that the Conference of European Statisticians recommended the preparation of a collection of documented practices on population projections.

38. The meeting approved the preparation of a collection of documented practices on population projections, and the creation of a Task Force for this purpose. The UNECE and Eurostat will contact member countries to identify potential candidates to work in the Task Force.

39. The meeting proposed that a similar work session would take place in the beginning of June 2009 in Cyprus.

### **V. Concluding remarks**

40. The participants expressed their appreciation and gratitude to the National Institute of Statistics of Romania for the excellent facilities and support provided for the meeting and for the social program offered to the participants. They also expressed appreciation to the members of the Scientific Committee for the topical assistance and the inputs that they had made to the meeting.

\*\*\*\*\*

(2) 報告資料 (スライド)

Population Prospects of the Lowest Fertility with the Longest Life:  
The New Official Population Projections for Japan and their Life Course Approaches

Ryuichi Kaneko  
National Institute of Population and Social Security Research  
Tokyo, Japan

I. Outlines of the Projection

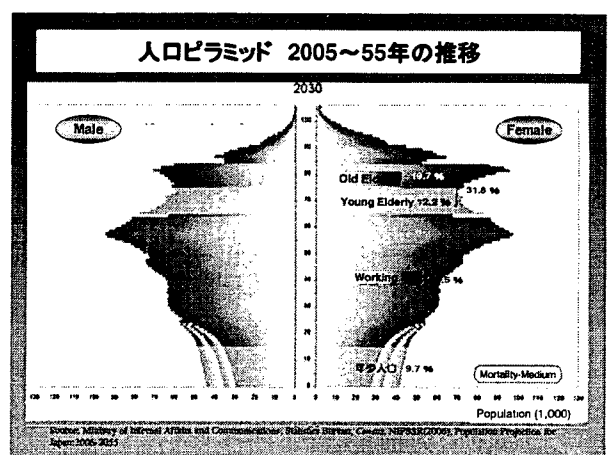
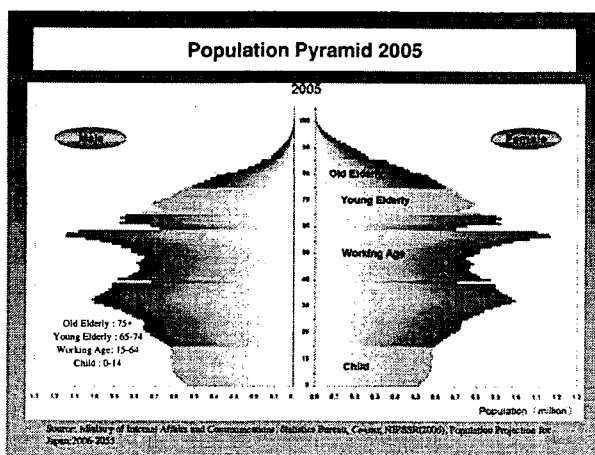
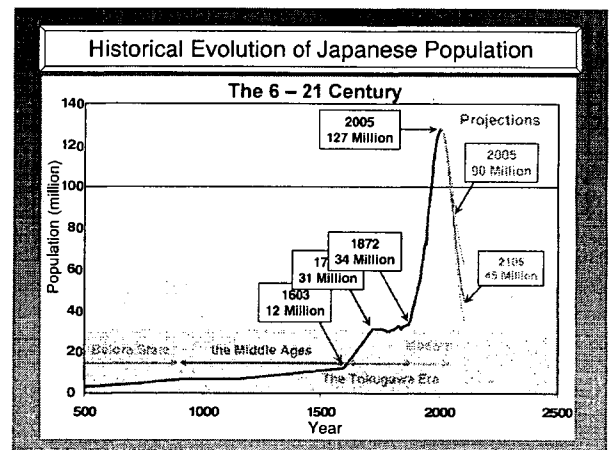
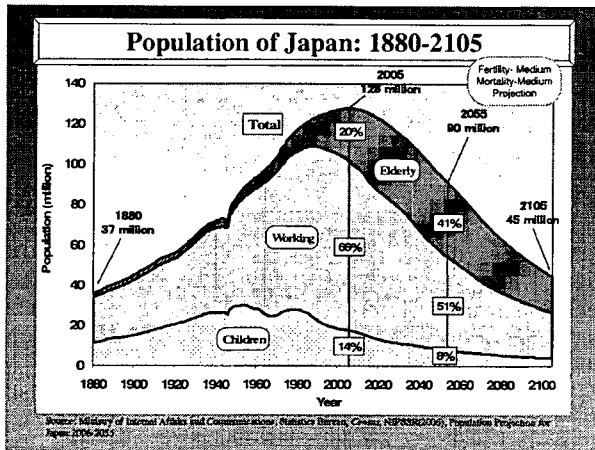
- Population prospects from the extreme vital conditions
- Reclaims normal life course assumptions

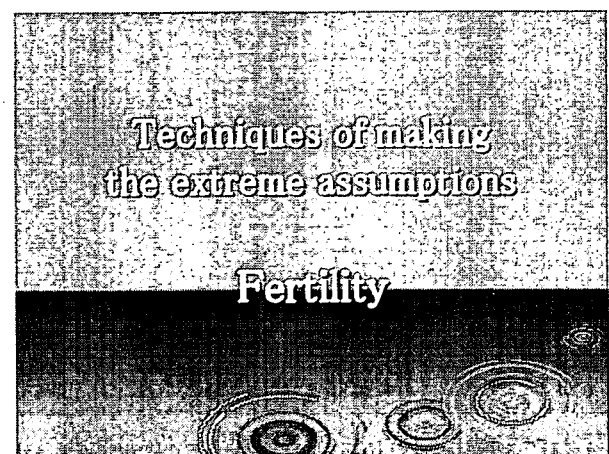
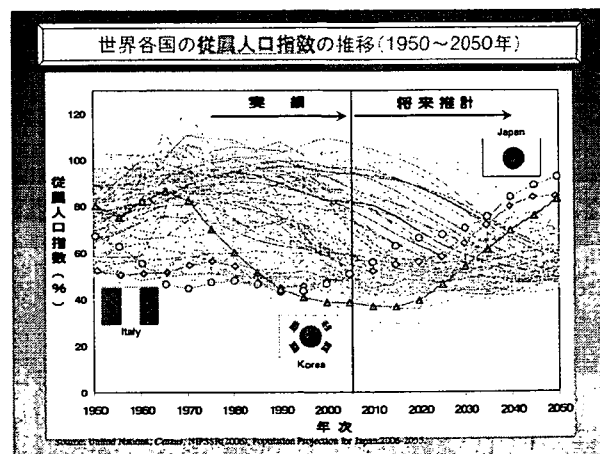
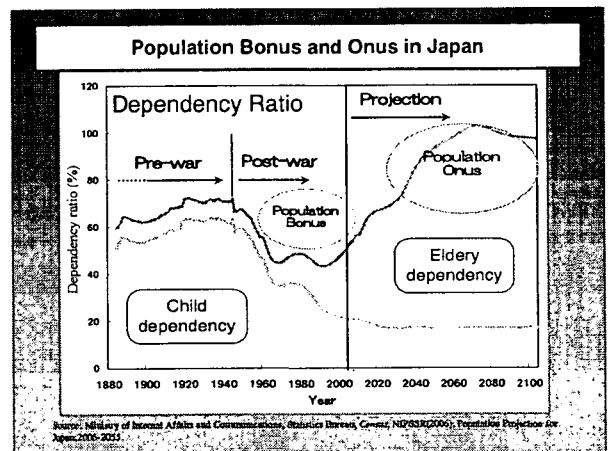
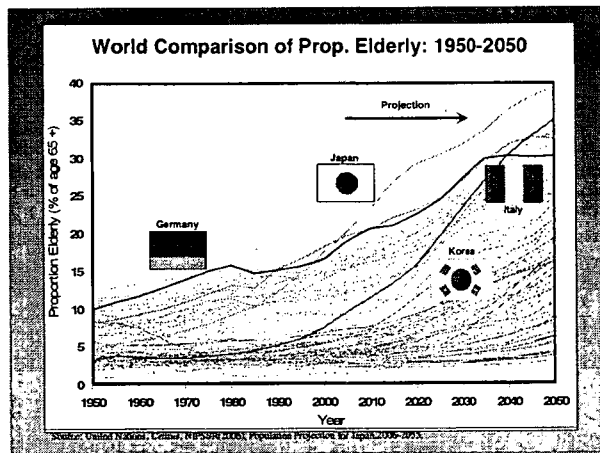
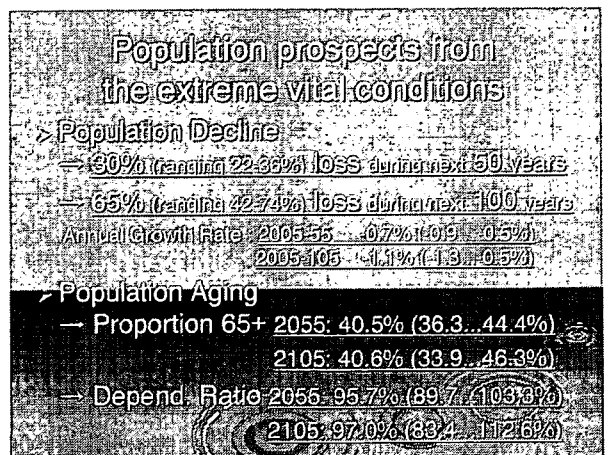
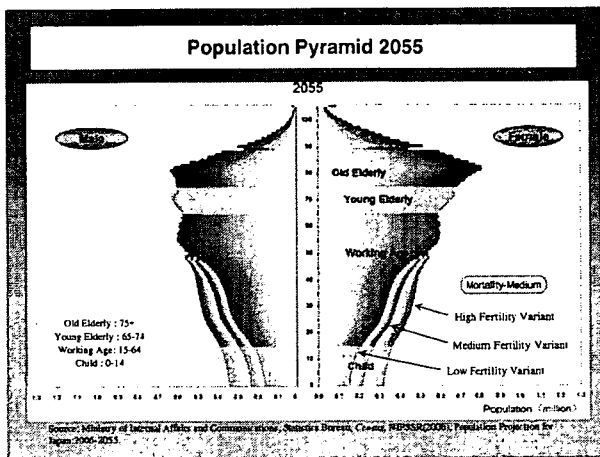
II. Life Course Construction

- Woman's lifetime probabilities of having births
- Woman's average lifetime length of period spent in a family status

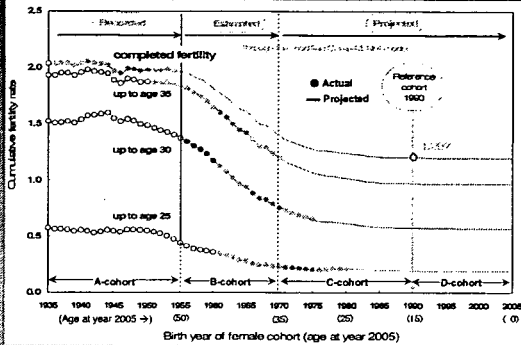
III. Discussion

- Do the complexities with life course approach deserve?



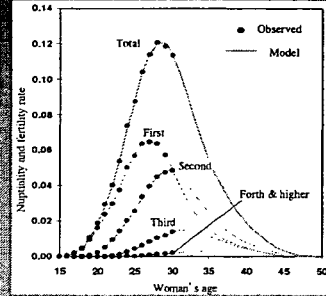


### コーホート出生率の投影—平成14年推計以後



### Projection Tool

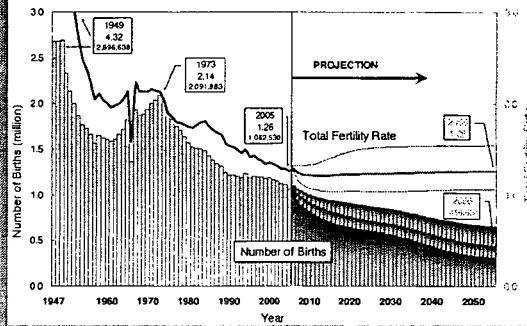
#### The Generalized log-gamma model



Measures of Fertility Components	Observed: cohort born in 1955	Assumptions of Population Projection: Female cohort born in 1990			
		Medium	High	Low	
(1) Mean age at first marriage	24.9	28.2	27.8	29.7	
(2) Proportion never married at age 50	5.8 %	23.5 %	17.9 %	27.0 %	
(3) Couples' completed fertility	2.16	1.70	1.91	1.52	
(4) Effect of divorce, widowhood and remarriage	0.952	0.925	0.938	0.918	
Children	0 (Childless Ratio)	12.7 %	37.4 %	28.6 %	43.3 %
	1 (Only-Child Ratio)	11.8 %	18.2 %	15.4 %	19.4 %
	2 and over	75.6 %	44.4 %	55.9 %	37.2 %
Cohort Total Fertility Rate (the rate only for birth from Japanese women)	1.94	1.25 (1.20)	1.55 (1.47)	1.06 (1.02)	

Source: Ministry of Health, Labour and Welfare, *Yasai Seisaku*, NIPSSR(2006), Population Projection for Japan: 2006-2055

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



Source: Ministry of Health, Labour and Welfare, *Yasai Seisaku*, NIPSSR(2006), Population Projection for Japan: 2006-2055

### Techniques of making the extreme assumptions

### Mortality

### Modeling Mortality Schedules

The Lee-Carter Method was employed as a framework.

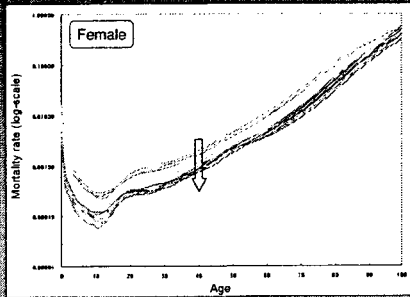
$$Y_{x,t} = \ln m_{x,t}$$

$$Y_{x,t} = a_x + b_x k_t + \varepsilon_{x,t}$$

- $\ln(m_{x,t})$  Log-mortality rate in age  $x$  and year  $t$
- $a_x$  Standard age pattern of mortality
- $b_x$  Standard age pattern of mortality change
- $k_t$  Index of the overall mortality level in year  $t$
- $\varepsilon_{x,t}$  Error term

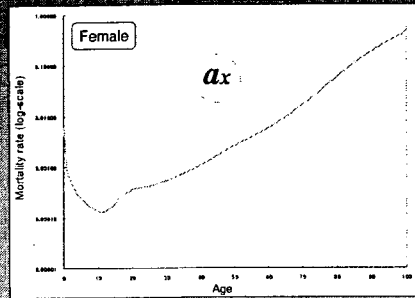
### Modeling Mortality Schedules

Age-specific Mortality Rates : 1965~2004



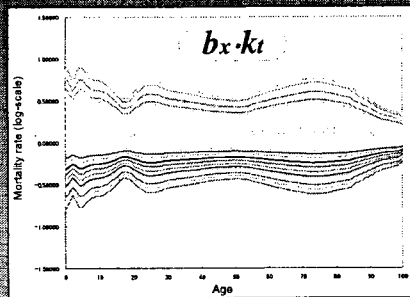
### Modeling Mortality Schedules

Average Mortality Schedule : 1965~2004



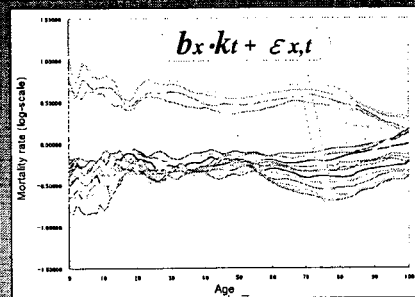
### Modeling Mortality Schedules

Pattern of Mortality Change : 1965~2004



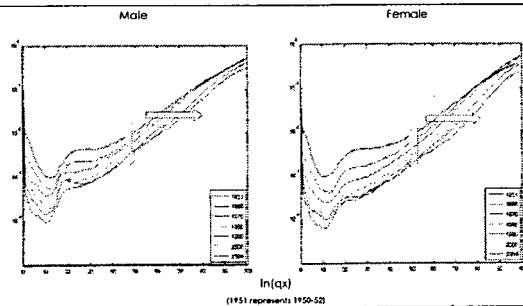
### Modeling Mortality Schedules

All of Mortality Change : 1965~2004

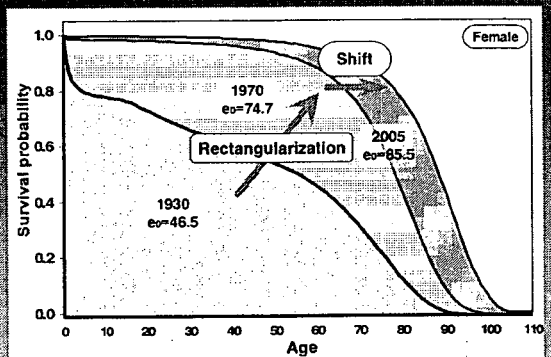


### Modeling Mortality Schedules

There are additional pattern of mortality changes seen in the recent development of age-specific mortality rate in Japan.



### Mode Change in Mortality Improvement



## Modeling Mortality Schedules

### The Shifting Logistic Model

The recent mortality changes in the low mortality countries with improvements in old ages can be seen as shifts of the aging process toward older ages. It is modeled by shift of the logistic curve fitted to mortality rate (Bongaarts 2005)

$$\text{3-parameter logistic function } \mu_{x,t} = \frac{\alpha \cdot \exp(\beta, x)}{1 + \alpha \cdot \exp(\beta, x)} + \gamma$$

$\mu_{x,t}$  : the force of mortality  $\alpha, \beta, \gamma$  : three parameters

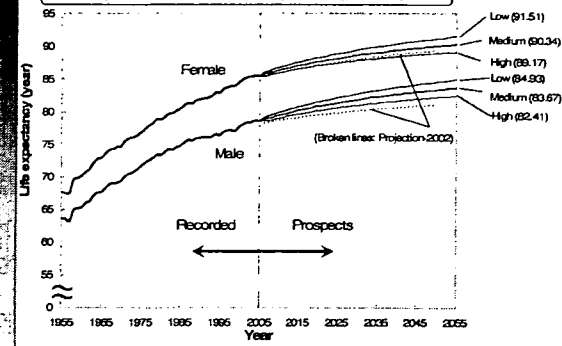
Parameter for mortality curve shift  $S_t = -\ln(\alpha_t) / \beta_t, x \geq 50$

$S_t = 0, x < 25$  Interpolation,  $x < 25$

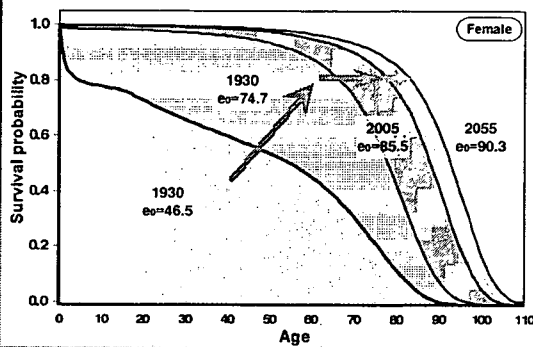
The Lee-Carter method is applied to the data set of the shifted mortality rates with the Shifting Logistic Model.

## Long-term Trends of Life Expectancy

### Life Expectancy : Three Mortality Assumptions by Sex



## Mode Change in Mortality Improvement



## I. Outlines of the Projection

- Population projects from the extreme vital conditions
- Impacts of making extreme assumptions

## II. Life Course Construction

- Woman's lifetime probabilities of having births
- Woman's average lifetime length of period spent in a family status

## III. Discussion

- Do the complexities with life course approach deserve

## Woman's Lifetime Probabilities of Eventual Family Status

Table 3 Derived from Multistate Life Tables

Family Status	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	85.8	82.1	78.3	76.4	75.7	75.7	
Having 1st birth	81.6	82.3	79.2	75.2	68.8	64.5	63.6	62.1	61.9	
Having 2nd birth	70.4	71.1	65.8	58.8	49.8	45.7	44.6	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	29.8	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	98.2	96.8	97.3	97.7	98.0	98.1	

(Note: The projections are tentative values calculated by the author from the assumption of the Population Projection for Japan, 2000-2055, NIPESR(2000).

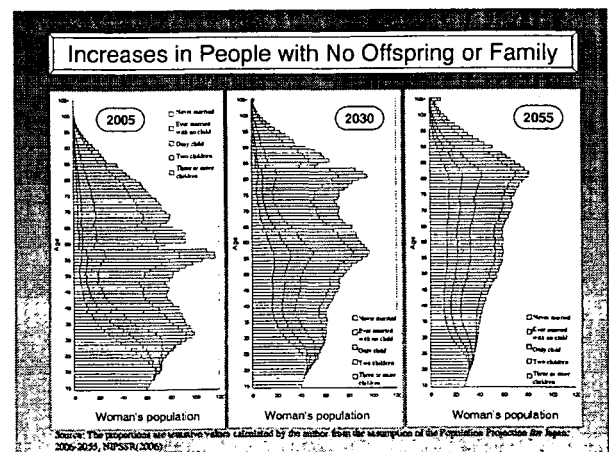
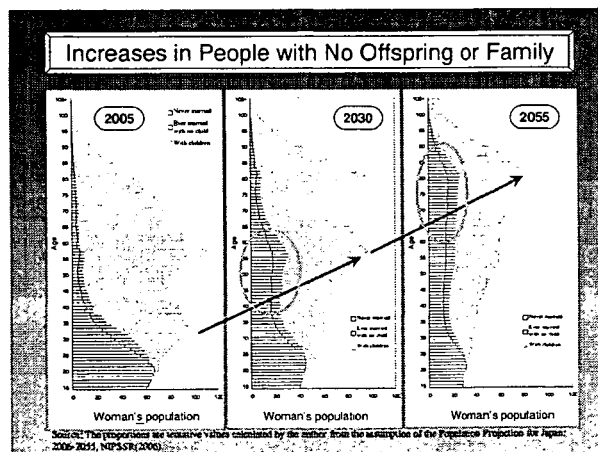
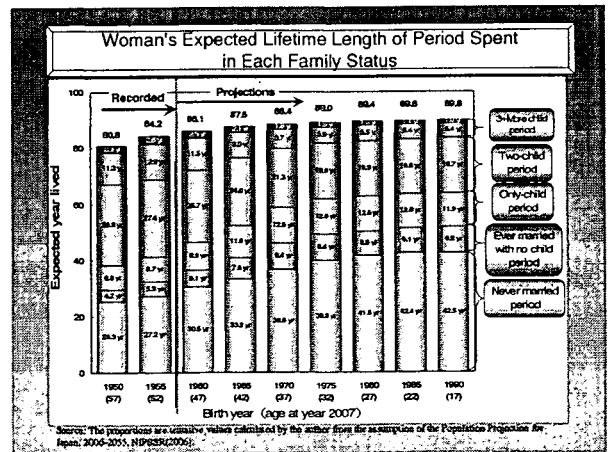
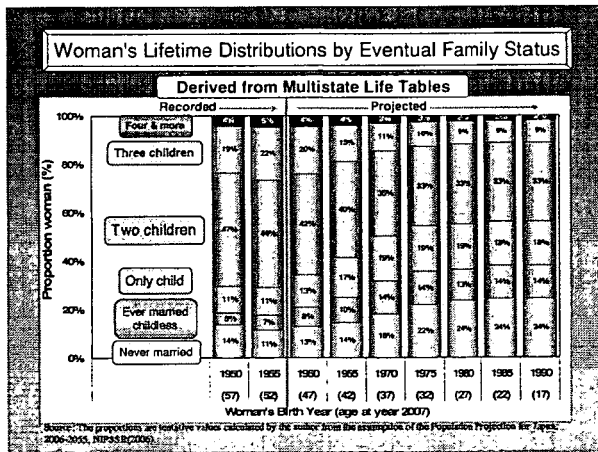
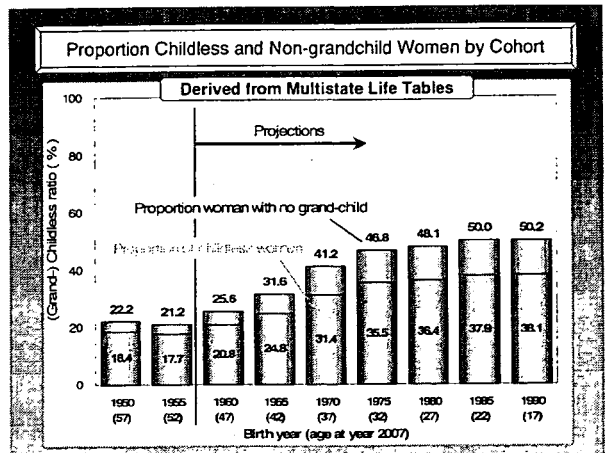
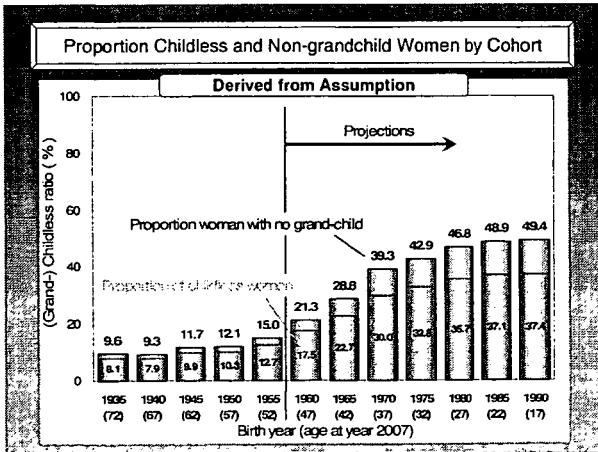
## Woman's Lifetime Distributions by Eventual Family Status

Table 3 Derived from Multistate Life Tables

Family Status	Birth year of woman's cohort									
	Recorded		Projected							
	1950	1953	1960	1965	1970	1975	1980	1985	1990	
Life time distribution of woman by number of child (at birth)										
Childless	16.4	17.7	20.8	24.8	31.4	35.5	36.4	37.9	38.1	
Never married	13.6	11.2	13.9	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	48.8	44.4	41.8	39.5	35.2	32.9	33.0	32.6	32.6	
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	3.6	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	59.0	58.1	57.9	
No grandchild	22.2	21.2	25.6	31.6	41.2	46.8	48.1	50.0	50.2	

### Derived from Assumption

Life time proportion of woman (without mortality effect - directly derived from fertility assumption)										
Never married	5.0	5.8	8.3	12.0	16.2	20.4	22.8	23.8	23.8	
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	





## Conclusion

## The latest population projections of Japan

- With the extreme assumptions, illustrate possible unprecedented demographic evolution that all of the human societies may experience in this century.
- Call for attention not only to population decline and aging, but also to the radical changes in individual life courses.

## The life course approach in population projection

- Provides rich information on people's life in upcoming society.
- Is a promising basis of new "paradigm" of the projection in the era of the Second Demographic Transition.

## The life course approach in population projection

- Requires significant amount of quality data and complex models.
- Deserves, however, all efforts to overcome such difficulties.

## The life course approach in population projection

- Wants formulation techniques for individual life courses.
  - The event history models, agent-based simulation techniques, decision making theories, and so on.
- Needs enhancement of the demographic data collection through upgrading national statistical systems.

Thank you ...



## Trends in Partnership Behaviours in Japan from a Cohort Perspective

Miho IWASAWA and Ryuichi KANEKO

National Institute of Population and Social Security  
 Research, Tokyo, Japan

## Fertility assumptions and partnership behaviour

- ❶ Assumptions about the future age-specific fertility rates required for population projection can be obtained using the cohort fertility method.
- ❷ With this method, we predict the average completed family size of younger cohorts, based on the actual birth process of preceding cohorts.
- ❸ Since childbearing behaviour is affected by family formation and dissolution, it is essential to examine these processes in constructing and assessing the future fertility assumptions.

2

## The NIPSSR's new population projections for Japan

- ❶ Conducted by the National Institute of Population and Social Security Research in 2006. Based on the 2005 census.
- ❷ TFR in 2030 is assumed to be between 1.04 – 1.53 (1.24 for medium variant)
- ❸ There has been growing concern that the very low future fertility would result in difficulties in maintaining current pension systems.

3

## Low-fertility regions by selected partnership characteristics

Age at first mar.	Prevalence of			Region
	Marriage	Cohabitation	Divorce	
Low	High	High	Low	
		Low	High	Eastern Europe (bu,pl,ro,yu)
		High	High	Eastern Europe (cz,hu,it,md,ru)
	Low	High	Low	
		Low	High	
		Low	Low	
High	High	High	Low	
		Low	High	
		Low	Low	
	Low	High	High	Northern Europe, Western Europe, Northern America, Australia/New Zealand
		Low	Low	Eastern Asia, Southern Europe
		Low	High	

UN.2003. Partnership and reproductive behaviour in low-fertility countries (rearranged by the present authors).

4

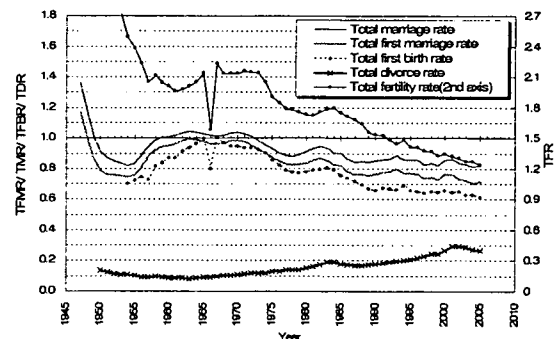
## Low-fertility regions by selected characteristics of partnership

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		High	High	Eastern Europe (cz,hu,it,md,ru)
	Low	High	Low	
		Low	High	
		Low	Low	
High	High	High	Low	
		Low	High	
		Low	Low	
	Low	High	High	Northern Europe, Western Europe, Northern America, Australia/New Zealand
		Low	Low	Eastern Asia, Southern Europe
		Low	High	JAPAN?

UN.2003. Partnership and reproductive behaviour in low-fertility countries (rearranged by the present authors).

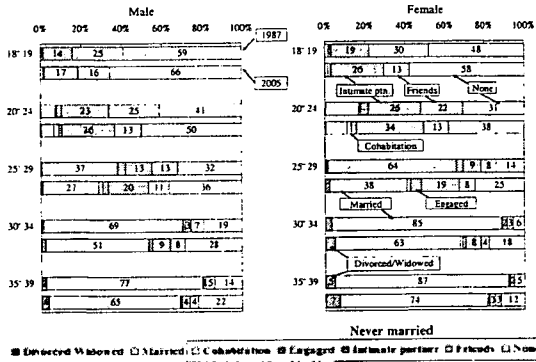
5

## Total fertility rates, total (first) marriage rates, total first birth rates, and total divorce rates among Japanese women



6

### Partnership status by age group in 1987 and 2005



Data: Japanese National Fertility Survey in 1987, 2005 (NIPSSR)

7

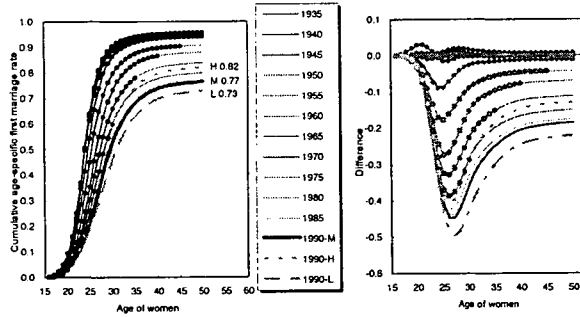
### Estimates of cohort indices of marriage and divorce

- ① Cohort age pattern of first marriage
- ② Proportion never-married at age 50
  - ③ The remainder of cohort cumulative age-specific marriage rates
- ③ Proportion ever-divorced among ever-married women at age 50.
  - ④ Cohort cumulative age-specific divorce rates to ever-married proportion by age 50.

8

### Cumulative marriage rates from a cohort perspective

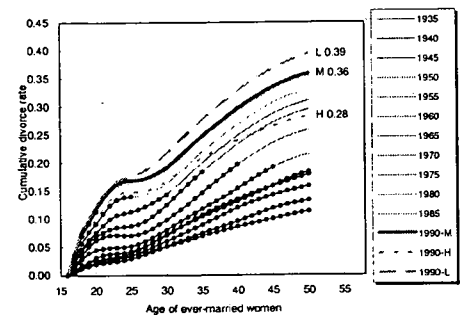
Cumulative age-specific first marriage rates: Actual values and assumptions, birth cohort 1935-1990  
Differences in cumulative cohort first marriage rates between base(1950) and subsequent



9

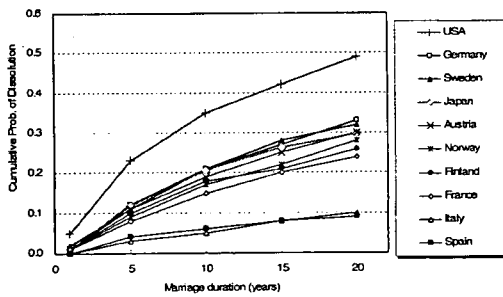
### Cumulative divorce rates by age from a cohort perspective

Cumulative divorce rates among women who have been married at least once: Actual values and assumptions, birth cohort 1935-1990



10

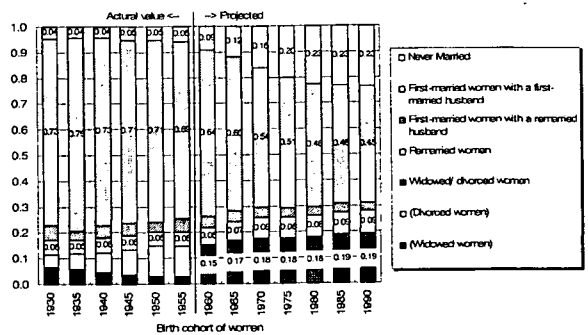
### Cumulative probability of marital dissolution by marriage duration (Life table estimates): Selected countries



For Japan, Raymo, Iwasawa, and Bumpass(2005, 2006). For others, Andersson and Philipov(2001)

11

### Marital status of women at age 50: Actual values and projected values, 1930-1990 birth cohorts



12

What impact does the change in partnership behaviour – declining marriage rates and increasing divorce rates – have on fertility?

CTFR  
↑

- ❑ First marriage behaviour
- ❑ Divorce, widowhood, and remarriage behaviour
- ❑ A couples' reproductive behaviour within marriage

13

Cohort cumulative fertility rate at age 50 (CTFR) is expressed as;

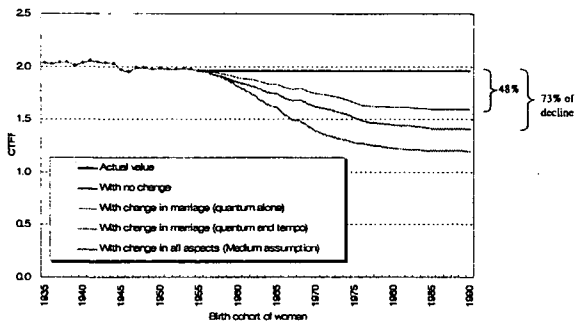
$$CTFR = (1 - \gamma) \cdot CEB \cdot \delta$$

$$= (1 - \gamma) \cdot (CEB^* (afm) \cdot \kappa) \cdot \delta$$

- ❑  $\gamma$ : the percentage of never-married women at age 50 (one minus cumulative first marriage rate)
  - ❑  $CEB$ : the completed number of children of women in first-married couples
  - ❑  $\delta$ : the coefficient reflecting divorce, widowhood, and remarriage effects
- The  $CEB$  can be broken down into  $CEB^*$  and  $\kappa$ :
- ❑  $CEB^*$ : the expected cumulative number of births based on the age pattern of first marriage ( $afm$ ) and the standard pattern of age-at-marriage-specific completed number of children.
  - ❑  $\kappa$ : a coefficient modifying the expected marital fertility rate.

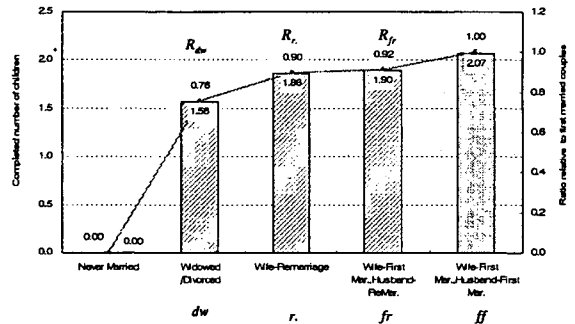
14

Simulated results with respect to marital behavior and medium assumption for cohort TFR, 1935-1990 birth cohorts



15

Completed number of children by marital status and relative ratio to first married couples



Data: Women aged 40-49 in the 13th Japanese National Fertility Survey (2005).

16

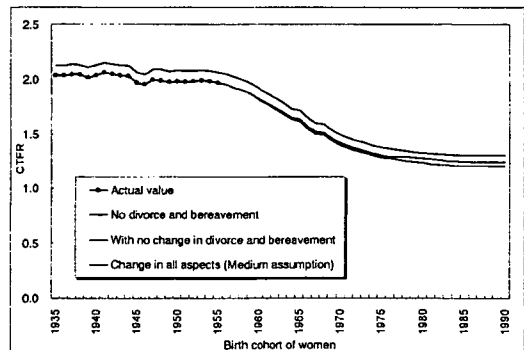
The coefficient of the divorce and widowhood effects,  $\delta$  was set in the following manner;

$$\delta = \{P_{ff} + P_{fr} R_{fr} + P_{r,r} + P_{dw} R_{dw}\} / (1 - \gamma)$$

- ❑  $P_{..}$ : the prediction of the composition of female marital status ( $ff, fr, r., dw$ ) at age 50
- ❑  $R_{..}$ : the indices for each marital status ( $fr, r., dw$ ) relative to the average number of children of the first-marriage couple ( $ff$ )

17

Simulated results with respect to divorce behavior and medium assumption for cohort TFR by birth cohort of women



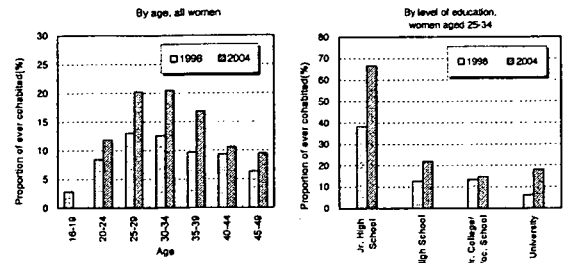
18

What is going on with the linkage between marriage and childbearing?

- ❑ Nonmarital cohabitation
- ❑ Nonmarital childbearing

19

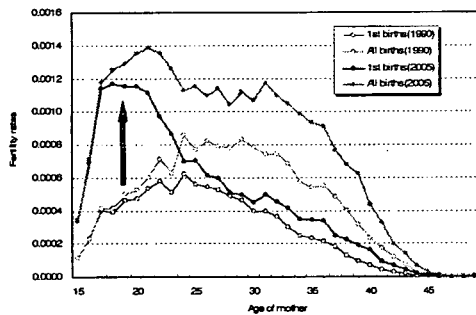
### Proportion of women who have ever cohabited: 1998 and 2004



Source: Own calculations from the 24th National Survey on Family Planning (1998) and the 1st SPFG(2004) conducted by the Population Problems Research Council, the Mainichi Newspapers (Iwasawa 2005).

20

### Age-specific non-marital fertility rates: 1990 and 2005



21

### Conclusion

- ❑ In 2030, the medium variant TFR for Japanese women is assumed to be 1.24.
- ❑ Among the 1990 birth cohort, the mean age at first marriage is 28.2, the proportion never-married at age 50 reaches 23.5%, and 36% of first-married women eventually experience divorce.

22

### Conclusion

- ❑ Over 70% of the CTFR decline is attributed to a decline in marriage rates.
- ❑ If divorce/widowhood behaviour remains unchanged from the 1955 birth cohort, CTFR would rise by 3% in the 1990 birth cohort.
- ❑ Premarital cohabitation is increasing, but the linkage between marriage and childbearing remains strong.
- ❑ Increase in unwed teenage mothers might indicate similarity with the patterns of family formation of Anglo-Saxon countries?

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## 2 将来人口推計の手法と仮定に関する総合的研究： 研究行程の流れ図

## 2 将来人口推計の手法と仮定に関する総合的研究：研究行程の流れ図

