

Are Mortality and Health Marriage Related? A Study based on Taiwan Experience

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Outline

- Motivation
- Current Marital Statistics in Taiwan
- Marriage Related Medical Analysis
- Application of Insurance Policy Design
- Conclusion

Motivation

●Late Marriage

→ The proportion of single increases for ages 20-34;

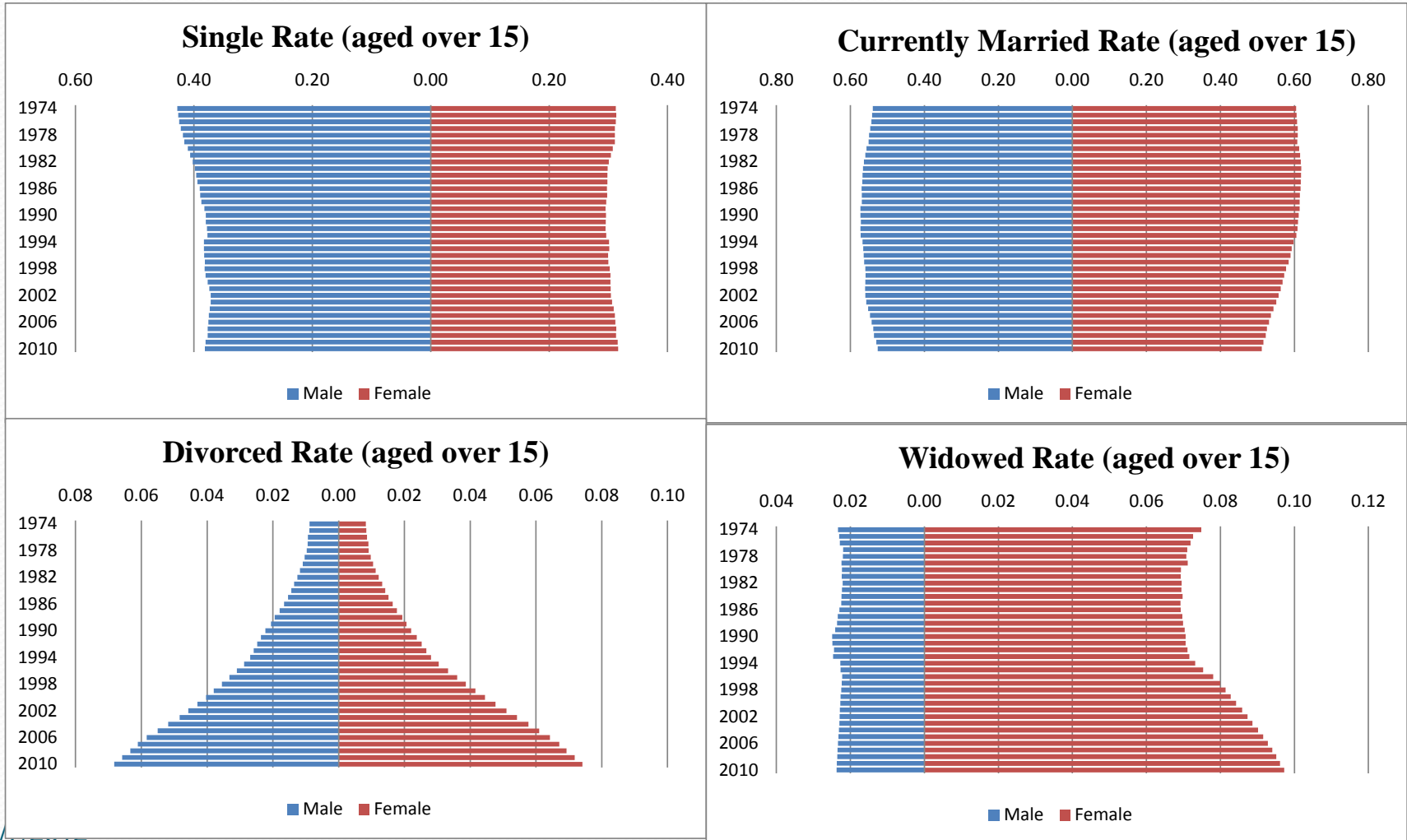
→ The age of first marriage grows from 21.88 in 1990 to 23.66 in 2010.

→ Divorce rate is increasing rapidly. (5 Marriages vs. 2 Divorces in 2010)

Data Source: Department of Household Registration Affairs, MOI.

Motivation

● Late Marriage (Conti.)



Motivation

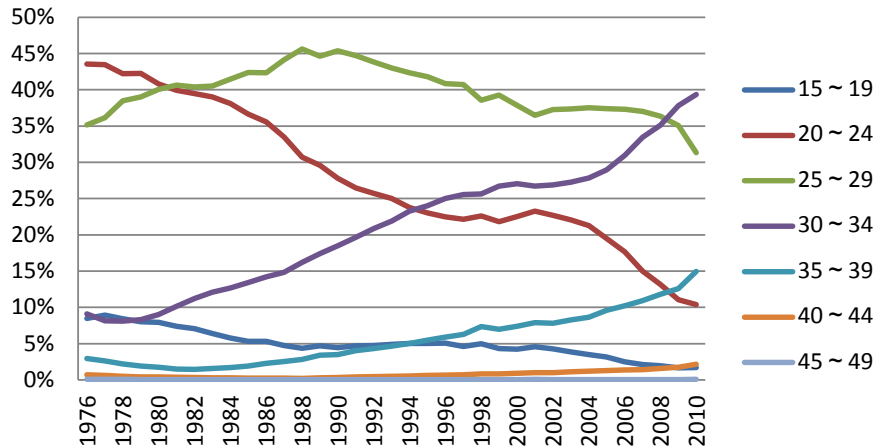
- Late childbearing

- The fertility rates and number of births decline at all ages except for the ages 30-34 & 35-39;
- The female with higher education (college & more) has fewer children;
- Total fertility rate (TFR) was 6 in 1960's and has been decreasing since (0.89 in 2010 & 1.06 in 2011).

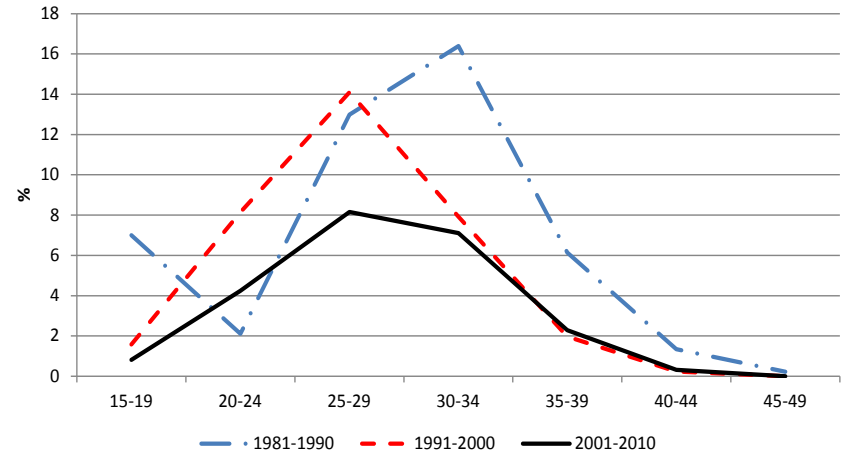
Motivation

● Late childbearing (conti.)

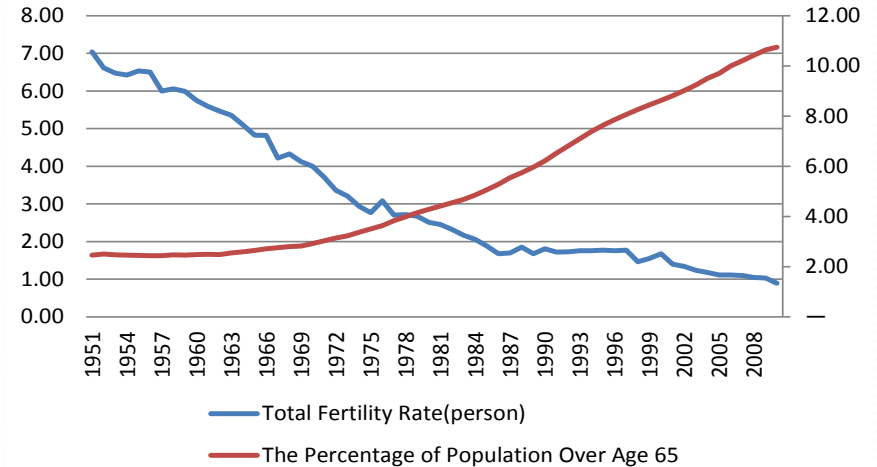
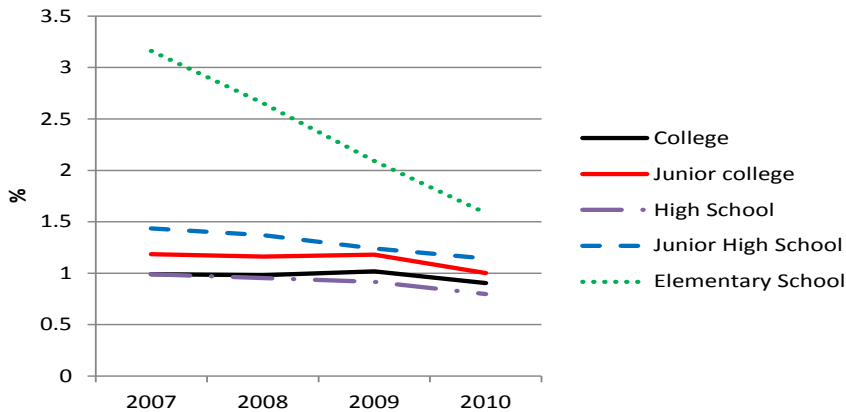
The percentage of births number



Fertility Rates of Childbearing Age Women



Total Fertility Rate Education Women



Motivation

- Not only Cross-Sectional But also Longitudinal Data
- Both Large Sample Data and Population Data
- Combine Mortality Rate with Medical Analysis

Data Source:

1. Marital Mortality : 5-aged groups population data from Ministry of the Interior in Taiwan (1973-2010)
2. Marriage Related Medical Analysis: population and one million sample data from National Health Insurance Research Dataset(NHIRD) in Taiwan(1996-2010)

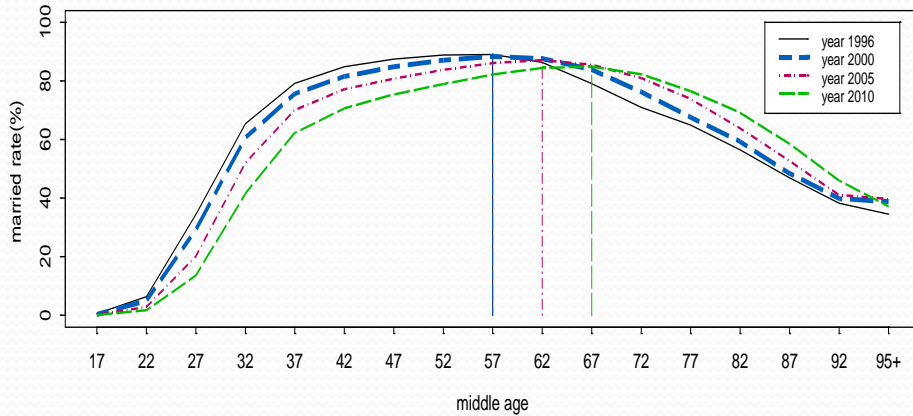
Current Marital Statistics in Taiwan

- Currently Married Rate Variation Trends:
 1. The nubile currently married rate declined quite significantly.
 2. The highest currently married male age was increased from 55~59 years old in 1996 to 65~69 years old in 2010
 3. The highest currently married female age was also increased from 40~44 years old in 1996 to 50~54 years old in 2010.
- This indication also showed the situation of late marriage.

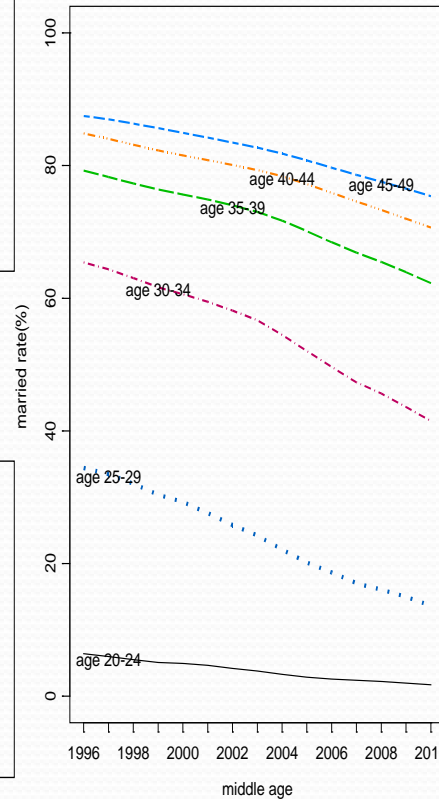
Current Marital Statistics in Taiwan

- Currently Married Rate Variation Trends:

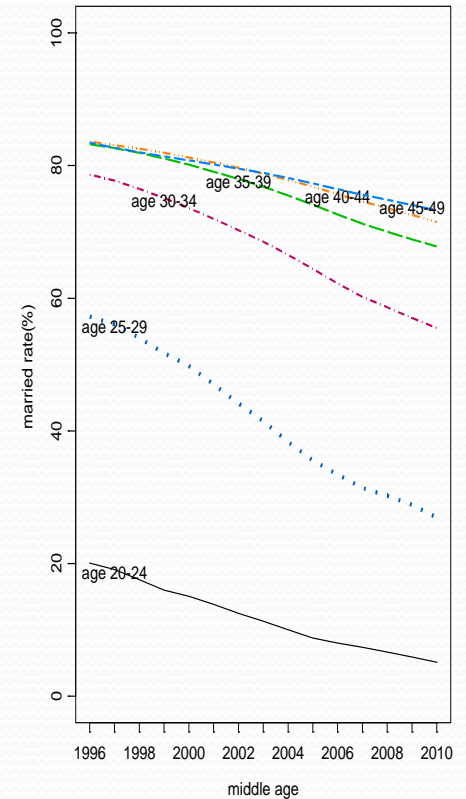
Taiwan Male Married Rate



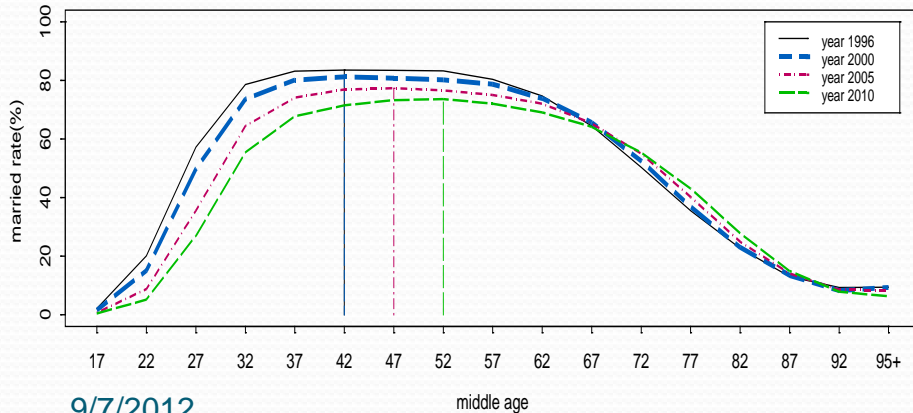
Male Married Rate(age 20-49)



Female Married Rate(age 20-49)



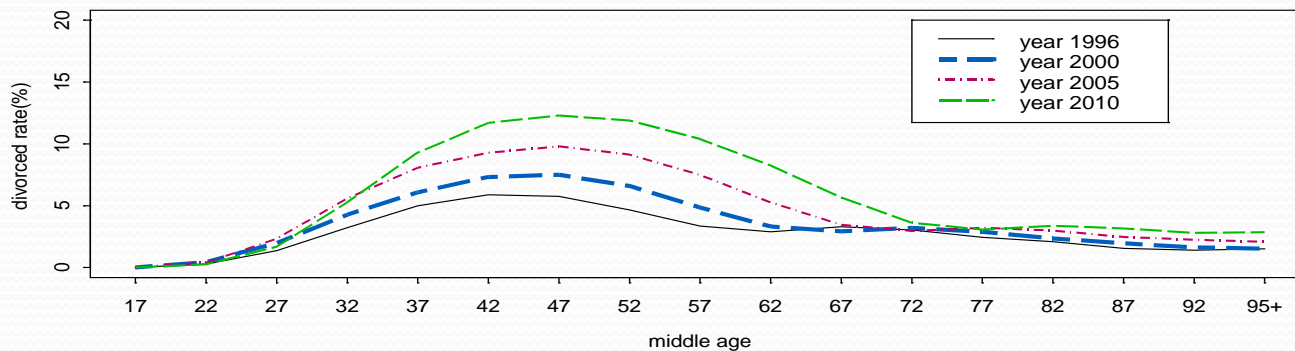
Taiwan Female Married Rate



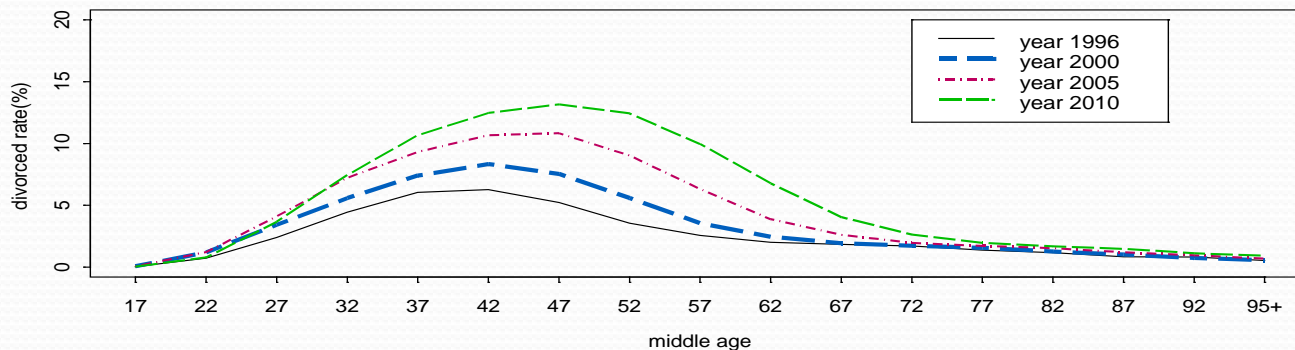
Current Marital Statistics in Taiwan

- Currently Divorced Rate Variation Trends:
 - There is an increasing phenomenon at elderly age section. This may represents the change of modern people's values of marriage.

Taiwan Male Divorced Rate



Taiwan Female Divorced Rate



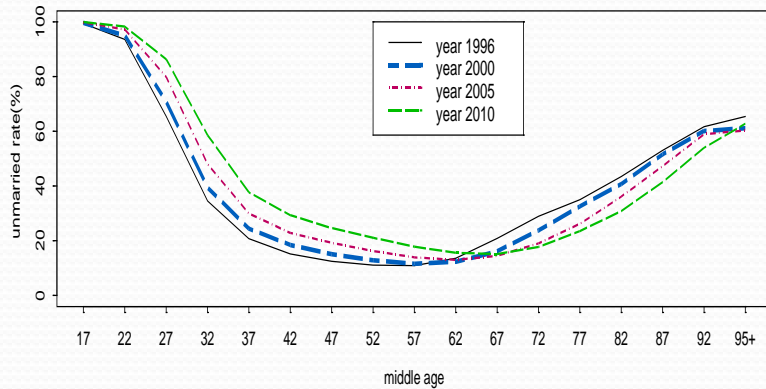
Current Marital Status and Mortality Situation Analysis

- Currently Unmarried Rate Variation Trends:
 1. Unmarried, including single, widowed and divorced
 2. No matter male or female, increased continuously before the nubile age
 3. It's declined at the elderly age and the male unmarried rate was even more significant.

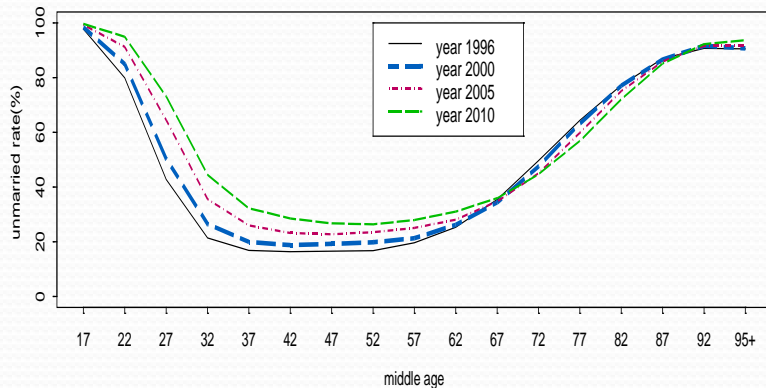
Current Marital Status and Mortality Situation Analysis

● Currently Unmarried Rate Variation Trends:

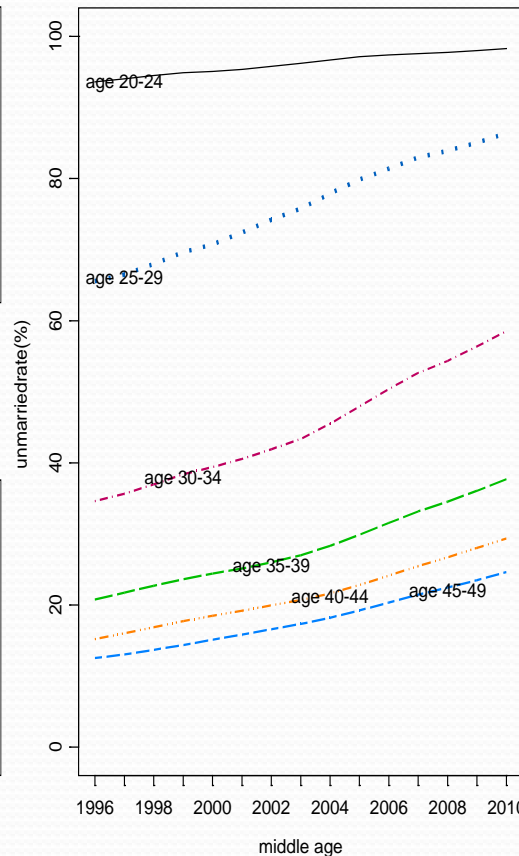
Taiwan Male Unmarried Rate



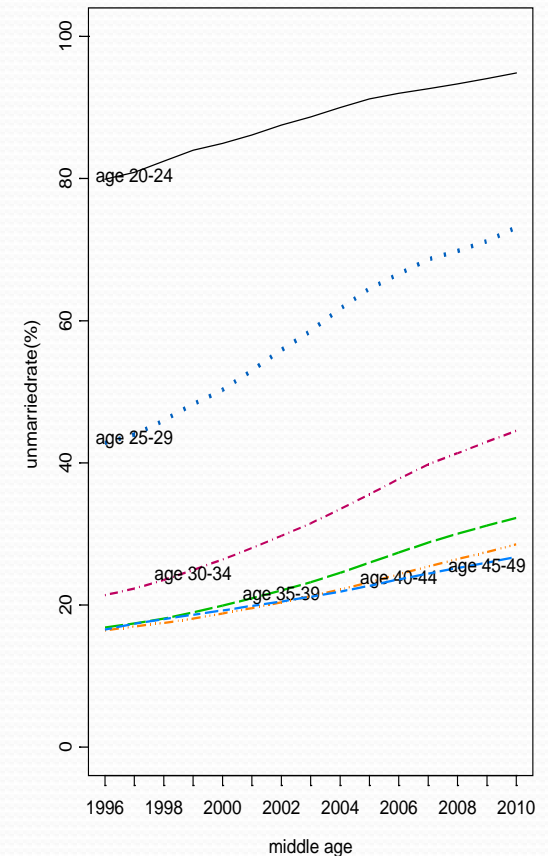
Taiwan Female Unmarried Rate



Male Unmarried Rate(age 20-49)



Female Unmarried Rate(age 20-49)

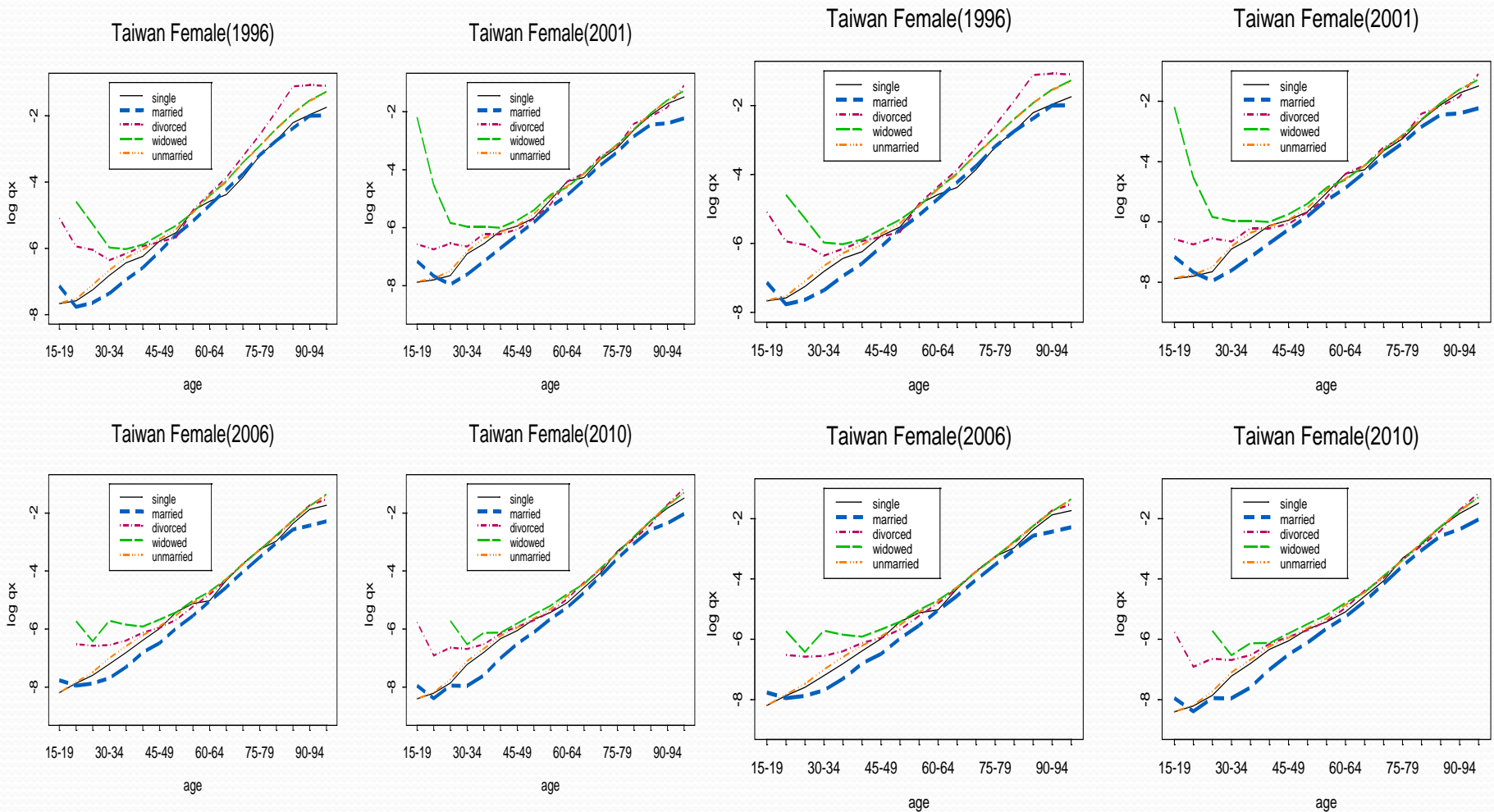


Current Marital Statistics in Taiwan

- Mortality Comparison in Different Marital Statuses:
 1. No matter male or female, married mortalities are the lowest.
 2. Marriage played active role in health and also increased average life expectancy indirectly.

Current Marital Status and Mortality Situation Analysis

● Mortality Comparison in Different Marital Statuses:



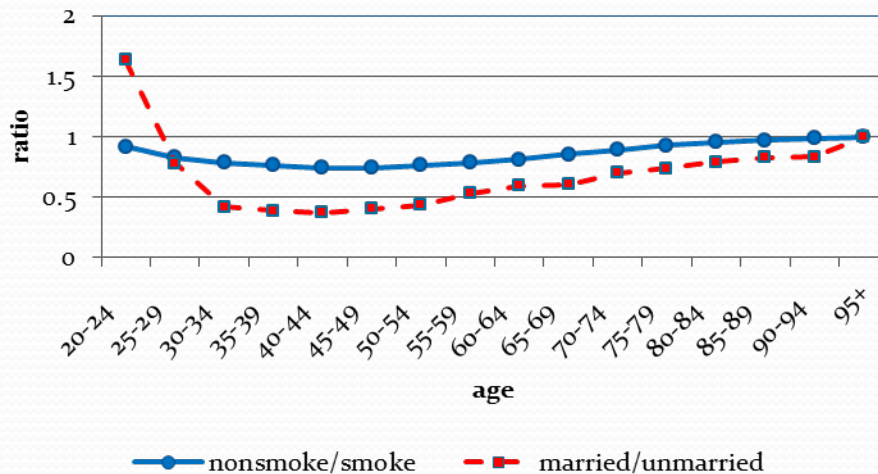
Current Marital Statistics in Taiwan

- Marriage Mortality Risk:
 - Marital and Smoking Status Mortality Comparison
 1. The differences between smoking and non-smoking mortality are clearly smaller than those between married and unmarried mortality.
 2. Male married mortality risk is significantly lower.

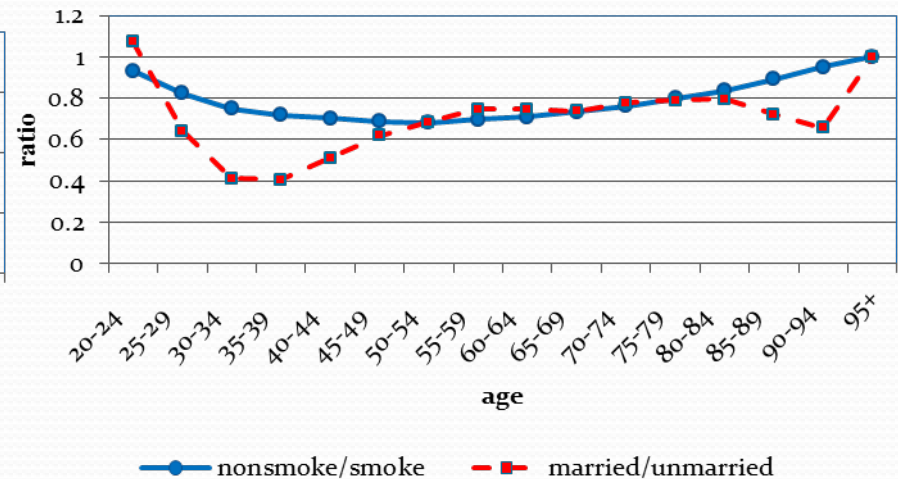
Current Marital Statistics in Taiwan

- Marriage Mortality Risk:
- Mortality Ratio Comparison

2007 Male Mortality Ratio Comparison

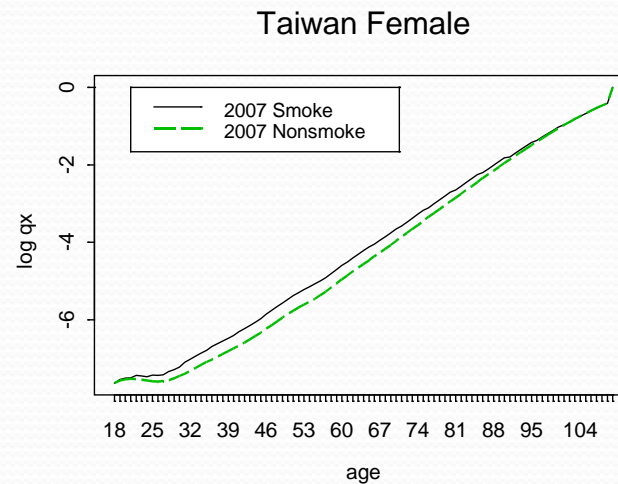
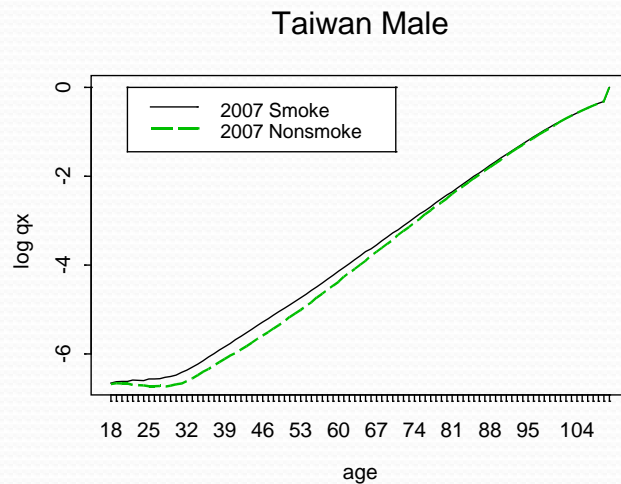
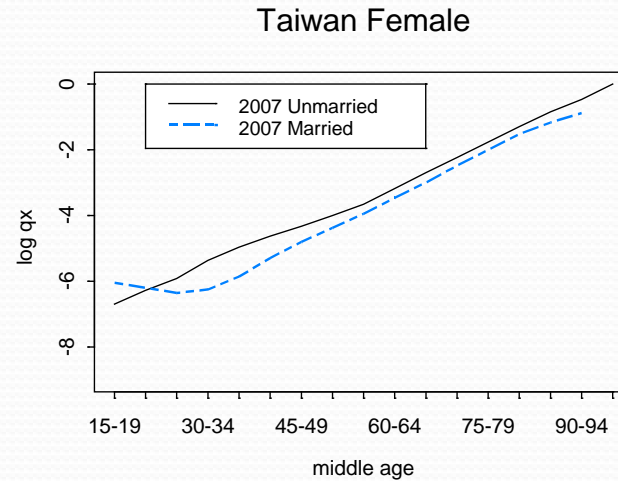
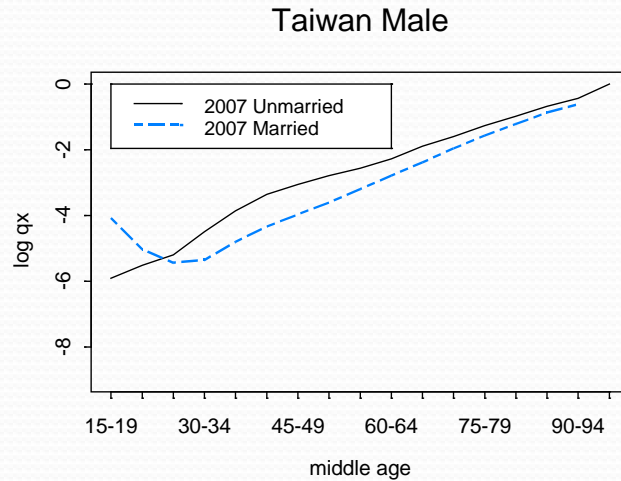


2007 Female Mortality Ratio Comparison



Current Marital Statistics in Taiwan

- Mortality Comparison

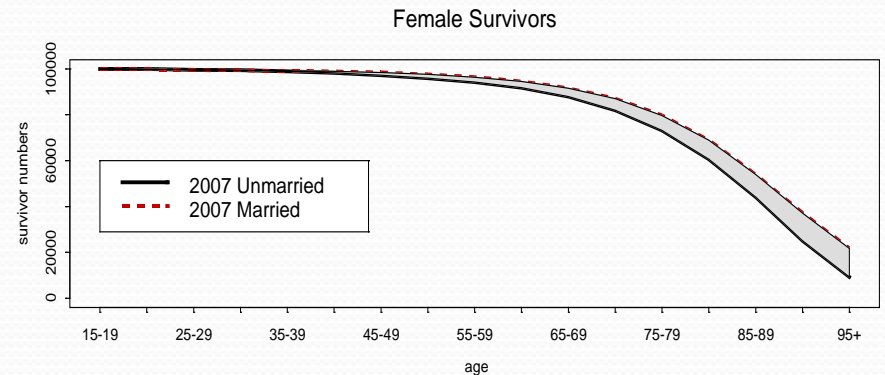
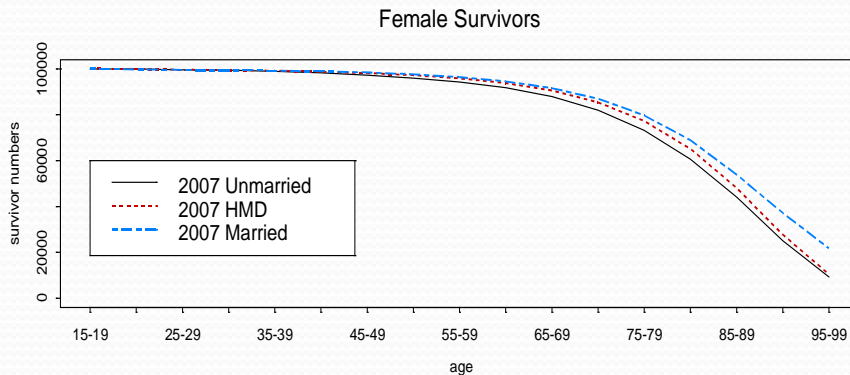
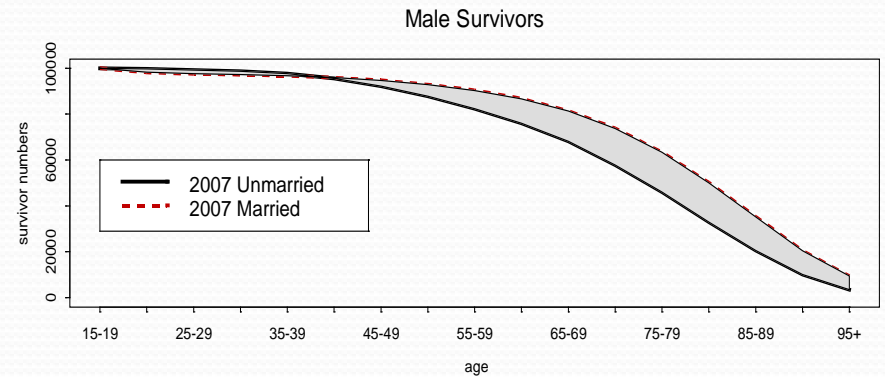
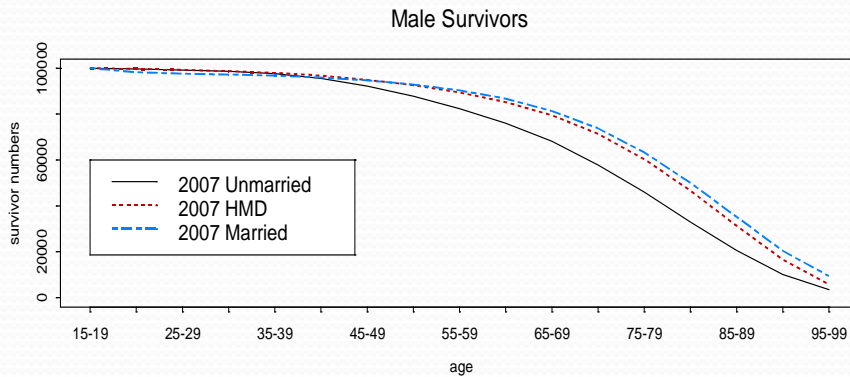


Current Marital Status and Mortality Situation Analysis

- Marriage Mortality Risk:
 - Marital Status , Number of Survivors and Life Expectancy
 - married male number of survivors and average life expectancy are much higher than unmarried.
 - If in considering the survival insurance, the potential longevity risk impact of marriage on the insurance company should also be paid special attention.

Current Marital Statistics in Taiwan

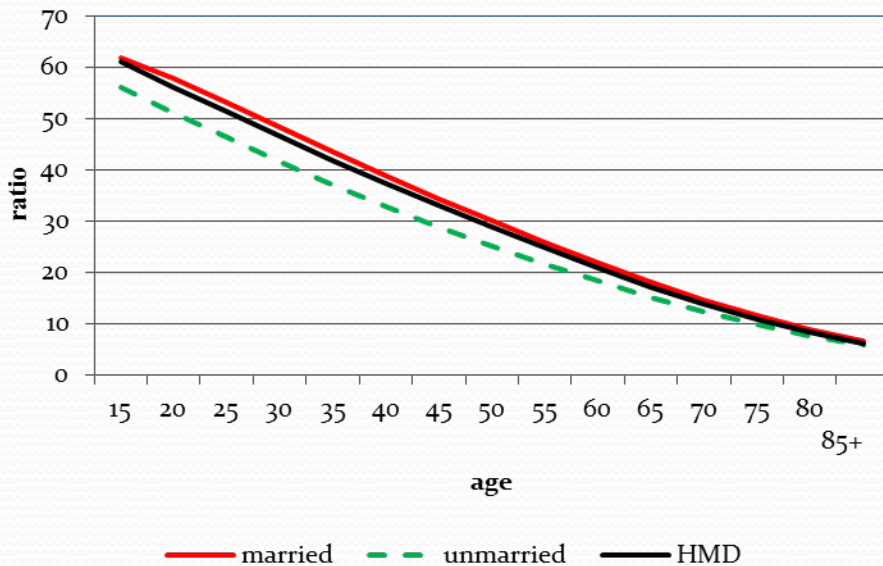
- Marriage Mortality Risk:
- Marital Status and Number of Survivors



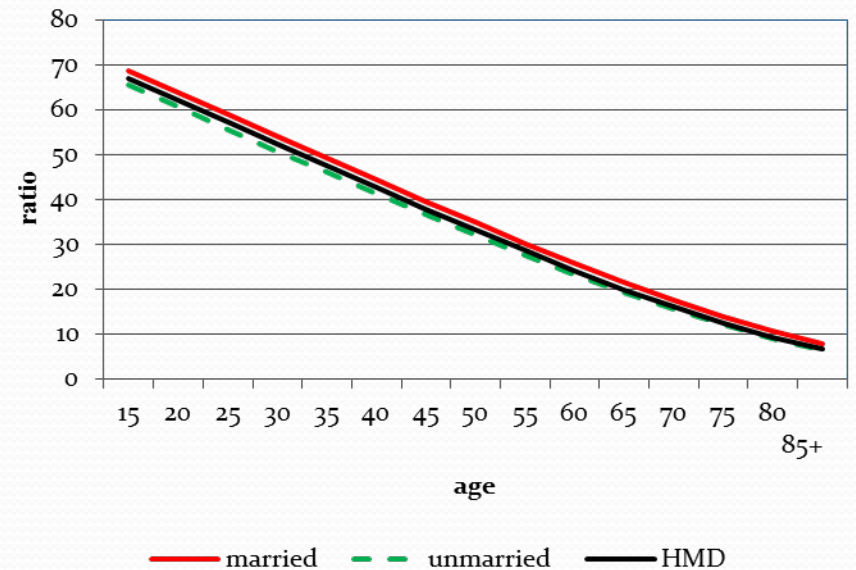
Current Marital Statistics in Taiwan

- Marriage Mortality Risk:
- Marital Status and Life Expectancy

Life Expectancy- 2007 male



Life Expectancy- 2007 female



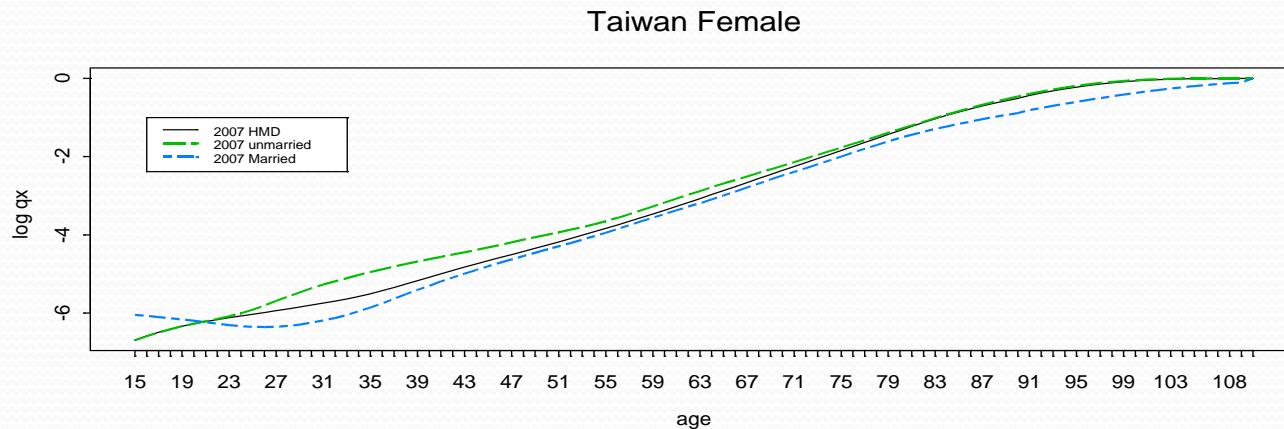
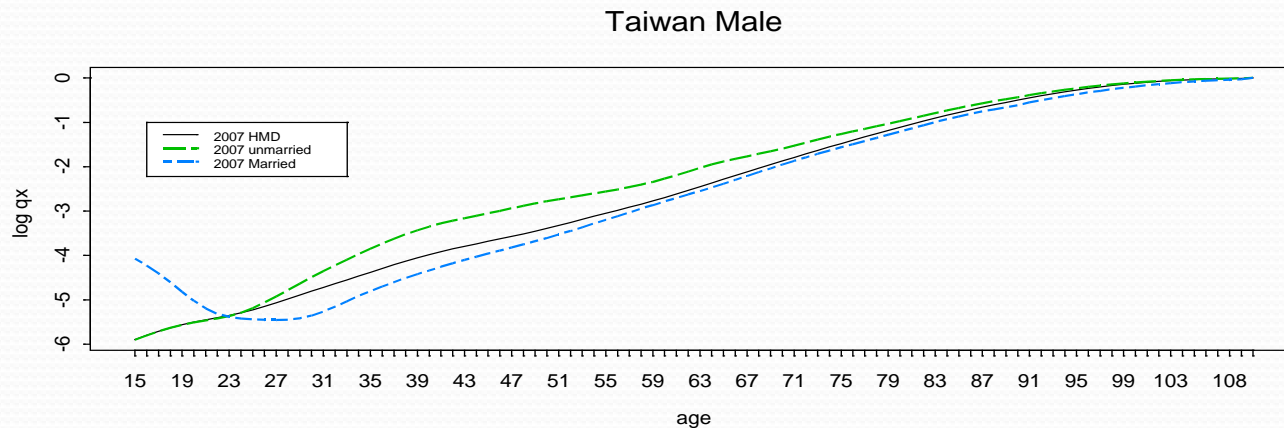
Current Marital Statistics in Taiwan

- Marriage Mortality Model Fit:
 1. Lee-Carter Model, the Renshaw-Haberman APC Model and the CBD two-factor Model
 2. From years 1996 through 2007 as the fitting data
 3. Mean Absolute Percentage Error (MAPE) as the criteria to evaluate the model forecast ability

	MAPE(100%)
Lee-Carter	3.3
RH	2.3
CBD	14.9

Current Marital Statistics in Taiwan

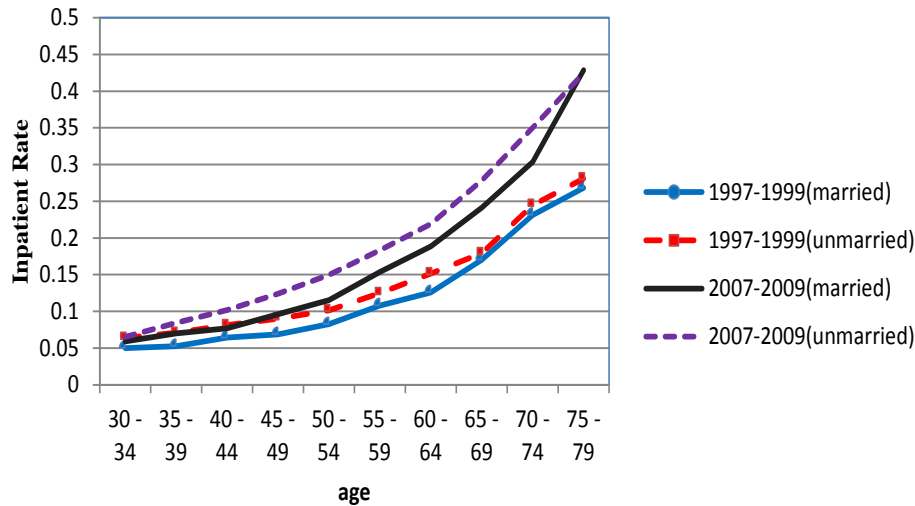
- Single Age mortality: Married mortalities are the lowest (married, unmarried, HMD)



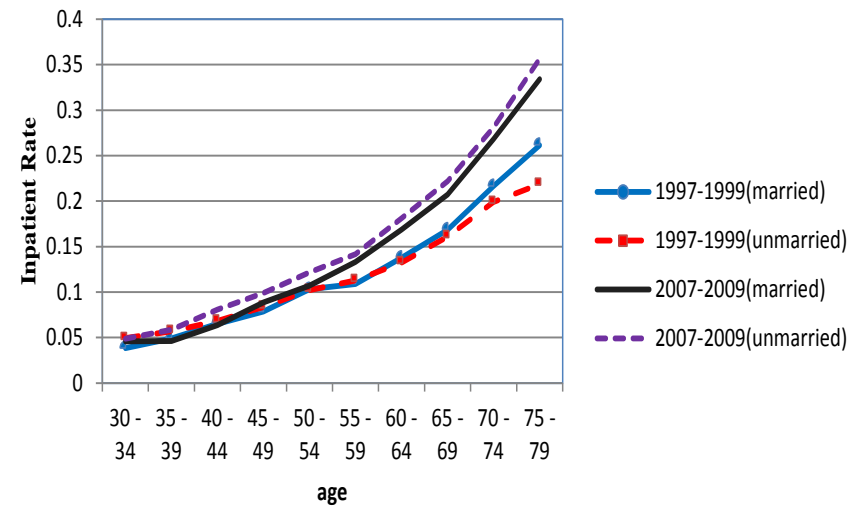
Marriage Related Medical Analysis

- Inpatient rate : Number of annual inpatients/Number of annual insured
- Married is significantly lower than unmarried .(age30-79)
- An upward trend on male inpatient rate with years

Male



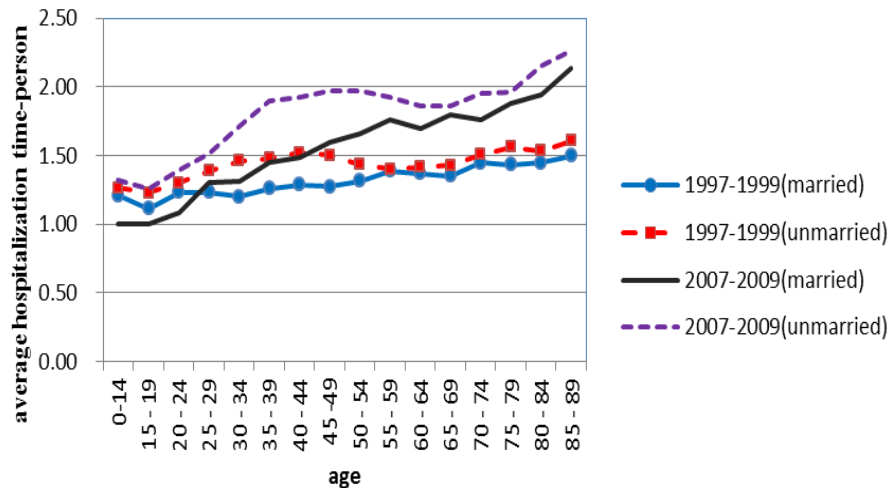
Female



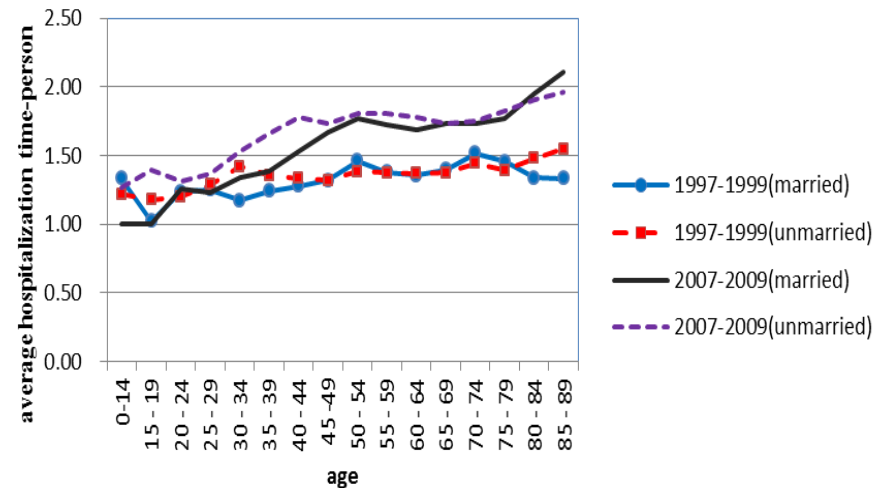
Marriage Related Medical Analysis

- Number of Each Inpatient Hospitalization Times : Number of Hospitalization Times / Number of Inpatients
- Annual average hospitalization frequency for unmarried people is almost higher than married people.

Male Inpatients



Female Inpatients



Marriage Related Medical Analysis

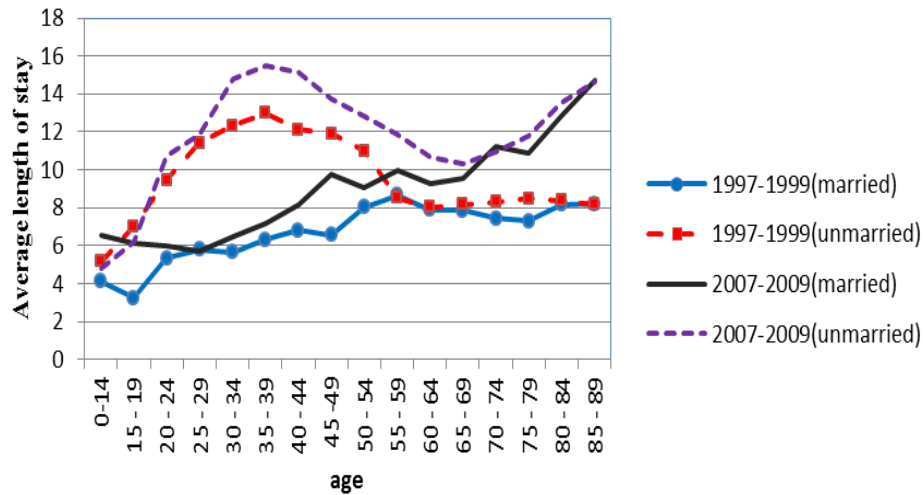
- Average Length of Stay : Inpatient Days/Number of Inpatients
 1. Married males is 9 days v.s. unmarried males is 11.8 days.
 2. Married females is 8.7 days v.s. unmarried females is 10.3 days.
 3. Under 50 years old, average length of stay for the unmarried female is also longer than married female.

*For example :2007-2009

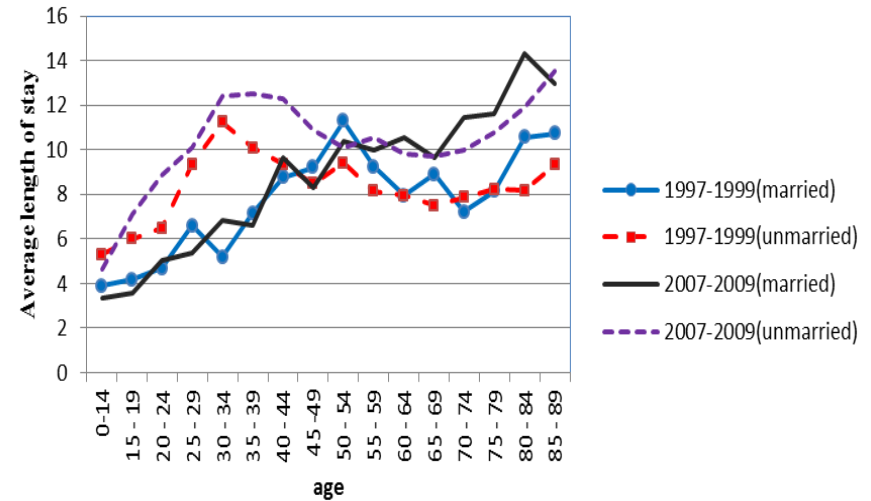
Marriage Related Medical Analysis

- Average Length of Stay : (Conti.)

Male(person-time)



Female(person-time)



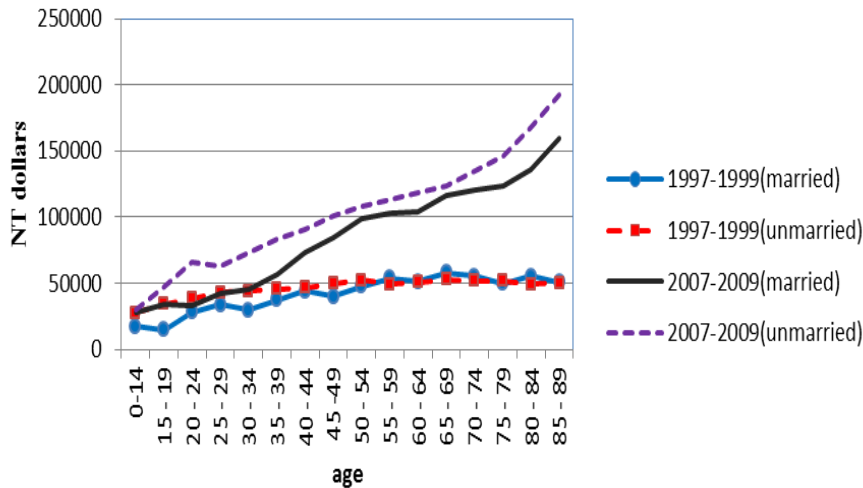
Marriage Related Medical Analysis

- Average Annual Inpatient Expenditures(per inpatient):
$$\text{Inpatient Medical Expenditures} / \text{Number of annual inpatients}$$
 - married male is NT\$ 54,025 v.s. unmarried male NT\$ 77,654
 - married female is NT\$ 55,814 v.s. unmarried female NT\$ 62,261
- * For Example: age 25-44

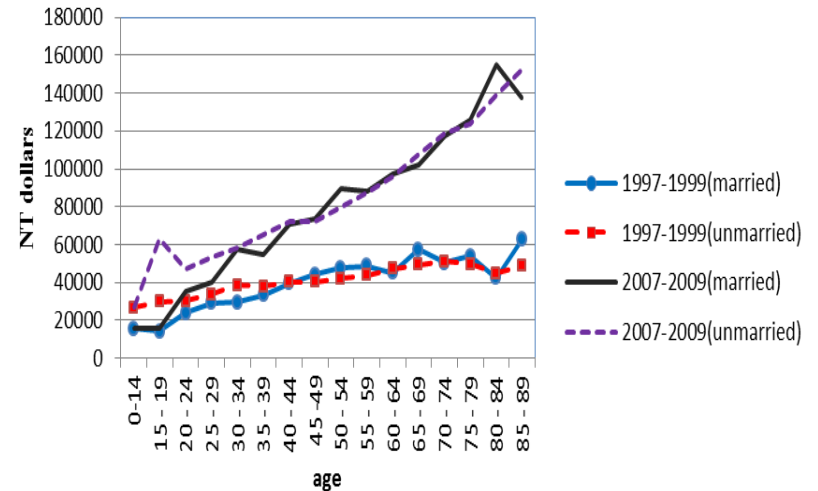
Marriage Related Medical Analysis

- Average Annual Inpatient Expenditures(per inpatient):

Male Average Hospitalized Medical Expenditures(per inpatient)



Female Average Hospitalized Medical Expenditures(per inpatient)



Application of Insurance Policy Design

- Pricing on Life Insurance product: based on 2007 period data

- Example 1:

20 Year Payment Whole Life(Insured Amount: \$1,000
Assumed Interest Rate: 2% and 5%)

- Example 2:

20 Year Payment Whole Life Health Insurance (Daily
Hospital Income : \$1,000 Assumed Interest Rate: 2%
and 5%)

Application of Insurance Policy Design

- Example 1: Whole Life (Interest Rate: 5%)
 - Net premium for male and female married are cheaper 30%-39% and 14%-22% than unmarried, respectively.
 - Net premium for married person is cheaper about 6%-16% than all people.

Age	Male				Female			
	Married	Unmarried	Mmarried/ Unmarried	Married/H MD	Married	Unmarried	Mmarried/ Unmarried	Married/H MD
30	23.13	36.84	0.63	0.84	15.52	19.99	0.78	0.92
35	28.78	46.88	0.61	0.86	19.40	24.25	0.80	0.93
40	35.48	57.72	0.61	0.88	24.24	29.30	0.83	0.94
45	43.83	69.40	0.63	0.90	30.21	35.68	0.85	0.94
50	55.18	83.81	0.66	0.91	37.90	44.30	0.86	0.94
55	71.31	103.21	0.69	0.93	48.57	56.97	0.85	0.93
60	94.11	134.02	0.70	0.93	64.01	76.25	0.84	0.92

Application of Insurance Policy Design

- Example 1: Whole Life (Interest Rate: 2%)
 - Net premium for male and female married are cheaper 24%-30% and 10% -14% than unmarried, respectively.
 - Net premium for married person is cheaper about 4%-9% than all people.

Age	Male				Female			
	Married	Unmarried	Mmarried/ Unmarried	Married/H MD	Married	Unmarried	Mmarried/ Unmarried	Married/H MD
30	37.28	49.18	0.76	0.91	30.60	34.52	0.89	0.96
35	42.14	58.06	0.73	0.91	34.10	38.27	0.89	0.96
40	47.89	67.79	0.71	0.91	38.28	42.59	0.90	0.96
45	55.23	78.57	0.70	0.92	43.35	48.03	0.90	0.96
50	65.53	92.40	0.71	0.93	49.96	55.62	0.90	0.96
55	80.76	111.68	0.72	0.94	59.48	67.25	0.88	0.95
60	103.03	142.48	0.72	0.93	73.93	85.67	0.86	0.93

Application of Insurance Policy Design

- Example 2: Whole Life Health (Interest Rate: 5%)
 - Net premium for married male is cheaper 12%-45% than unmarried.
 - Net premium for married male is cheaper about 14%-44% than all people. Little impact on female, special for older age.

Age	Male				Female			
	Married	Unmarried	Married/Unmarried	Married/HMD	Married	Unmarried	Married/Unmarried	Married/HMD
30	1652	3030	0.55	0.56	1736	2225	0.78	0.80
35	1959	3344	0.59	0.61	2120	2502	0.85	0.85
40	2308	3495	0.66	0.67	2542	2743	0.93	0.92
45	2783	3771	0.74	0.74	2893	2939	0.98	0.97
50	3272	4089	0.80	0.79	3348	3266	1.02	1.00
55	3849	4460	0.86	0.85	3857	3701	1.04	1.02
60	4572	5223	0.88	0.86	4486	4361	1.03	1.01
65	5490	6744	0.81	0.82	5465	5252	1.04	1.03
70	7638	8966	0.85	0.86	6898	6335	1.09	1.07

Application of Insurance Policy Design

- Example 2: Whole Life Health (Interest Rate: 2%)
 - Net premium for married male is cheaper 11%-32% than unmarried.
 - Net premium for married male is cheaper about 14%-26% than all people. Little impact on female, special for older age.

Age	Male				Female			
	Married	Unmarried	Married/Unmarried	Married/HMD	Married	Unmarried	Married/Unmarried	Married/HMD
30	2370	3507	0.68	0.64	2833	3098	0.91	0.89
35	2597	3702	0.70	0.67	3111	3256	0.96	0.93
40	2856	3784	0.75	0.72	3394	3372	1.01	0.97
45	3219	3990	0.81	0.77	3614	3460	1.04	1.00
50	3608	4259	0.85	0.81	3919	3672	1.07	1.03
55	4110	4622	0.89	0.85	4294	4006	1.07	1.04
60	4786	5386	0.89	0.86	4819	4579	1.05	1.03
65	5717	6891	0.83	0.83	5719	5407	1.06	1.04
70	7832	9072	0.86	0.87	7062	6465	1.09	1.07

Conclusion

- Conclusion
- The longevity risk caused by population aging: how to solve the low fertility problem.
- Advantage on the research : 1.Population Data
2.Longitudinal Data 3. Combine Mortality Rate with Medical Analysis
- The same results as scholars in many countries did: marriage has the role of health protection
- Promote preferred marriage policy:
 1. provide lower premium insurance products
 2. Insurance company may also gain potential insurants (newborns).

Conclusion

- Conclusion (Conti.)
- Married or not can be regarded as mortality risk factor
- Married male should get about 10%-45% net premium discount than unmarried male.
- Suggest the future social security disbursement should also take marriage forecast into consideration
- Provide insurance companies some references in designing life insurance products
- Indirectly encourage marriage motivation to increase fertility rate.



Thank you for your
attention.