Demographic and Socio-Economic Determinants of Birth Interval Dynamics in Iran:
A Hazard Function Analysis

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Demographic and Socio-Economic Determinants of Birth Interval Dynamics in Iran: A Hazard Function Analysis

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The lengths of time between marriage and giving birth to the first child and the interval between births have a crucial role in women's reproductive health. The number of children a woman can have during her reproductive life depends on the spacing of births. The length of exposure time to conception is well recognized as a main determinant of fertility. It plays the major role in Bongaarts and Davis and Blake's theories of fertility as well as other models of fertility determinants. Prolonged interval between births-through contraceptive use - is the major means for neutralizing the effect of duration of marriage on fertility. Birth spacing also known to its significantly affect on the health of mother and children.

This study investigates the socio-demographic determinants of the timing of first birth and child spacing in Iran. The interval between marriage and first child and birth of first child and that of second child are of main interest in this analysis. The data are drawn from a DHS-type survey conducted by the Ministry of Health and Medical Education and Statistical Center of Iran in 2000. The sample consists of 90,739 married women taken from all 28 provinces as well as Tehran Metropolitan Area. The paper applies the survival analysis approach including life table analysis, Cox, and Weibull Regression techniques.

The findings show significant but small differences in hazard ratios of different socio-demographic groups regarding the first child. They confirm the conjugal patterns hypothesis that married couples are under social pressure to prove their fertility by bearing a child within a short time interval after marriage. Only very young women married at ages that preclude the possibility of bearing a child have a long interval between marriage and first birth. The multivariate analysis reveals that labor force participation, age at marriage, current age and level of education are the main factors affecting postponing the first child. The analyses also show that women with different socio – demographic characteristics have different hazard ratios of giving birth to the second child. According to the final multivariate model the variables of age, level of education, survival of first child and age of mother at first delivery are the major factors affecting postponement of second child. The relationship is strong in the case of second child's birth interval than the first child. The analyses also indicate that the model used fits better with Weibull regression model than the exponential regression and distribution of survival data model.

Introduction

- This paper investigates the socio-demographic determinants of child bearing and child spacing in Iran.
- First two children and the interval dynamics between marriage and first child birth in one hand and interval between first child birth and that of second child on the other hand are of main interest in this essay.

Why Studying Birth Interval?

- It's contribution to fertility outcome
- Significant bearing in maternal and child health through:
  - Sibling Competition,
  - Maternal Depletion,
  - Interval effect.

(Gyimah, 2002: 2)

Major Question

- Whether there are demographic and socio-economic factors that affect the timing and spacing of 1st and 2nd birth in Iran?
- Whether there are different impacts of these factors on 1st child bearing and 2nd child spacing?

Background

- **According to Gyimah (2001, 2002)**:
  - A birth cohort is indicative of structural factors that have shaped the life of individuals.
  - The younger age at marriage or age at first birth, the higher the risk of birth (short interval birth)
  - The higher the development level of the region, the wider birth intervals
  - Significant relation between inter-birth interval and survival status of the index child
  - Breastfeeding and contraceptive use significantly correlate with birth interval

Background (Cont'd)

- Length of preceding interval correlates with succeeding one,
- Such socio-economic factors as urban residence, maternal education, age at marriage, knowledge and access to contraception, labor force participation and values regarding family size have considerable association with birth interval
- Socio-cultural factors as ethnic-specific practices, norms and values affecting reproductive behavior

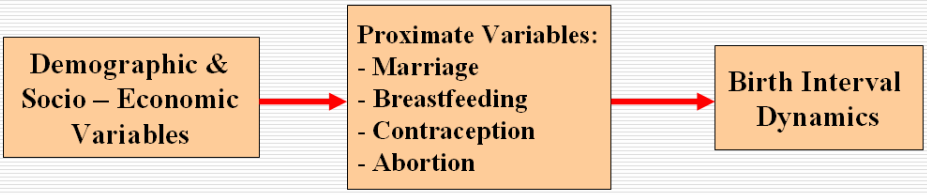
Background (Cont'd)

- **Rodriguez et al 1984 found that**:
  - Length of previous birth interval has a strong determination on subsequent birth interval,
  - Birth interval length depends on;
    - A little upon birth order,
    - But more upon the length of previous interval
  - Women's education, age and time period all have substantial effects on birth interval
- **Richards (1983)** incorporated both duration of breastfeeding and contraception

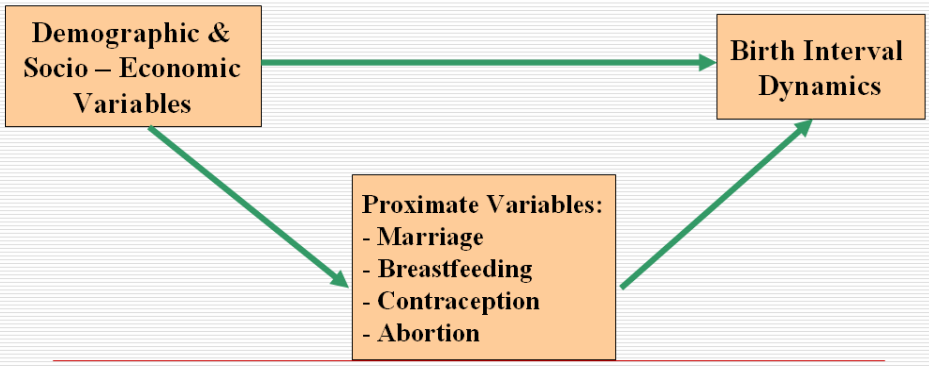
Background (Cont'd)

- **Rindfuss, Palmore and Bumpass (1983)** using WFS for five countries found that age of mother at first birth, urban experience and sex of preceding child are more important factors affecting birth interval.
- **Trussell and others (1985)** found that socio-economic factors don't have any independent effect on the birth interval; rather, these factors mainly extend their influence through biological or proximate determinants of the birth interval such as breastfeeding behavior, contraceptive use, coital frequency and induced abortion

PD Pathways – Conventional & Empirical Evidence Link



Rindfuss, Palmore and Bumpass: 1989: PP197-202



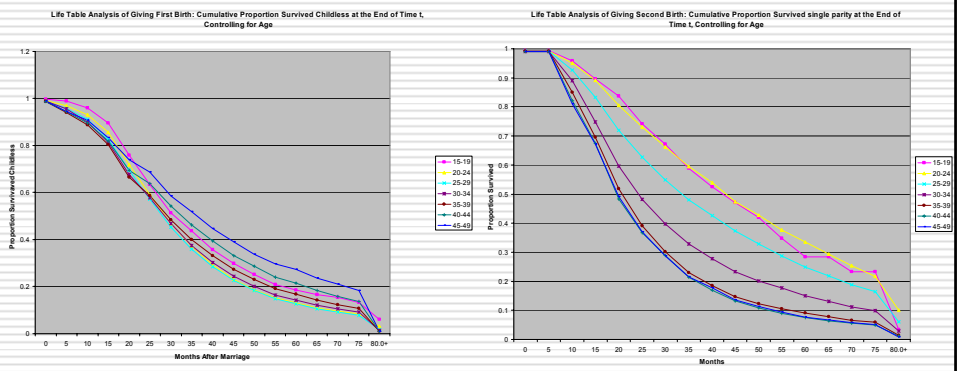
Data and Method

- Data drawn from Iranian 2000 DHS-type survey
- 90739 married women nested in 28 province along with Tehran MA
- The data analyzed at 3 stages:
  - Descriptive Analysis
  - Bivariate Analysis
  - Multivariate Analysis
- The survival analysis approach including life table analysis and Cox regression techniques have been used.

Descriptive Analysis

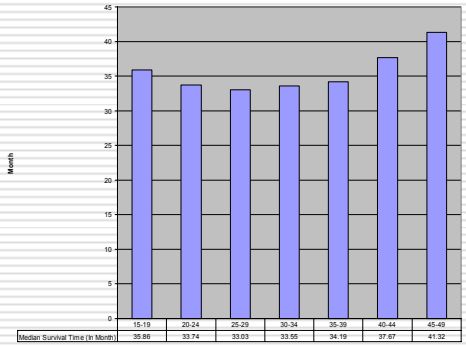
- Life Table analyses have been utilized to describe the differences in birth intervals by different categories of socio-demographic variables.
- Survival Function and Median Survival Time are two indices have been used to analyze data.

Timing of Birth and Age



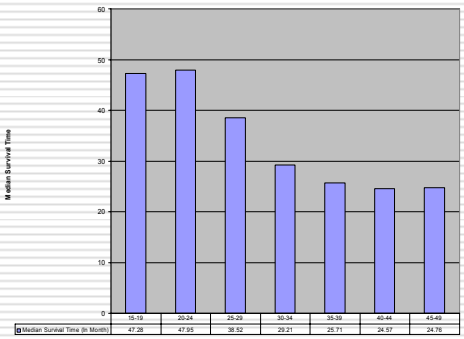
Median Survival Time

Median Survival Time, The Time Lag between Marriage and Giving First Birth Controlling for Age



	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Median Survival Time (In Month)	35.86	33.74	33.03	33.55	34.19	37.67	41.32

Median Survival Time, The Time Lag between First Delivery and Giving Second Birth Controlling for Age

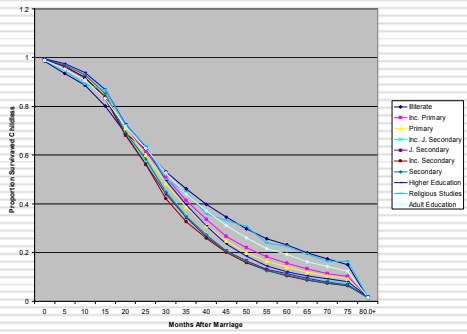


	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Median Survival Time (In Month)	47.28	47.95	38.52	29.21	25.71	24.57	24.76

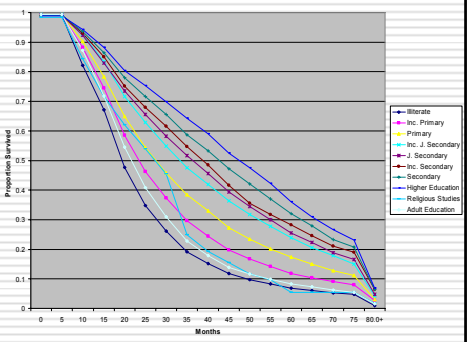
Timing of Birth in Iran

Timing of Birth and Education

Life Table Analysis of Giving First Birth: Cumulative Proportion Survived Childless at End of Time t, Controlling for Education



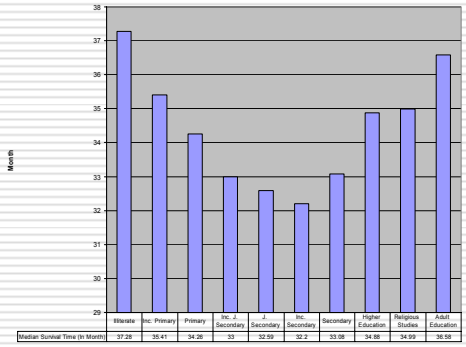
Life Table Analysis of Giving Second Birth: Cumulative Proportion Survived single parity at the End of Time t, Controlling for Education



Timing of Birth in Iran

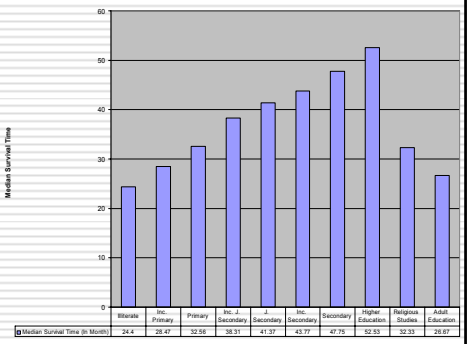
Median Survival Time

Median Survival Time, The Time Lag between Marriage and Giving First Birth Controlling for Education



	Illiterate	Inc. Primary	Primary	Inc. J. Secondary	J. Secondary	Inc. Secondary	Secondary	Higher Education	Religious Studies	Adult Education
Median Survival Time (In Month)	37.28	35.41	34.26	33	32.59	32.2	33.08	34.88	34.99	36.58

Median Survival Time, The Time Lag between First Delivery and Giving Second Birth Controlling for Education

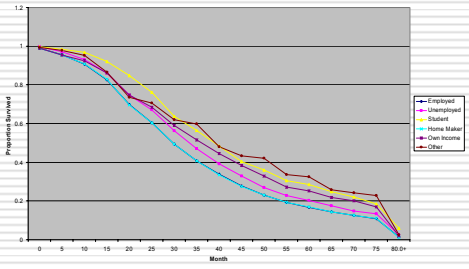


	Illiterate	Inc. Primary	Primary	Inc. J. Secondary	J. Secondary	Inc. Secondary	Secondary	Higher Education	Religious Studies	Adult Education
Median Survival Time (In Month)	24.4	28.47	32.56	38.31	41.37	43.77	47.75	52.53	32.33	26.67

Timing of Birth in Iran

Timing of Birth and Labor Force Participation

Life Table Analysis of Giving First Birth: Cumulative Proportion Survived Childless at the End of Time t, Controlling for Labor Force Participation



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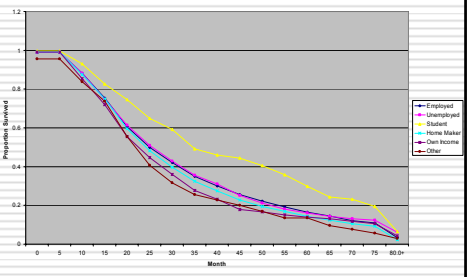
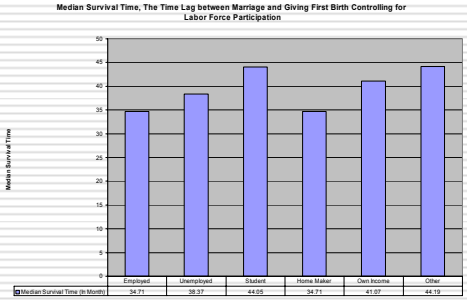
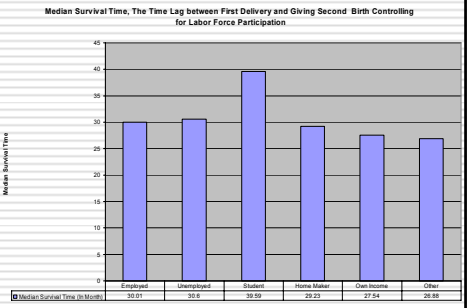


Timing of Birth in Iran

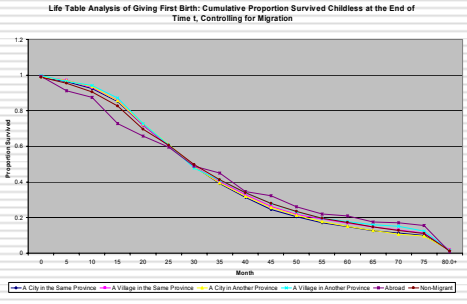
Median Survival Time

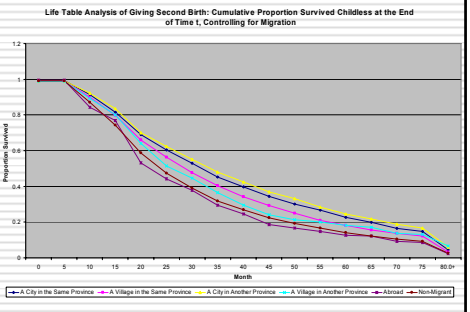




Timing of Birth in Iran

Timing of Birth and Migration

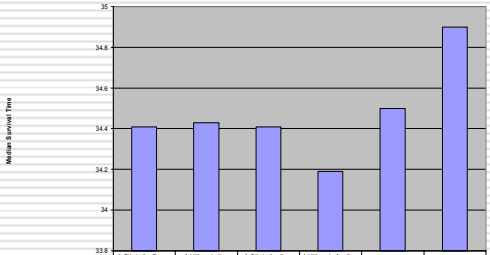




Timing of Birth in Iran

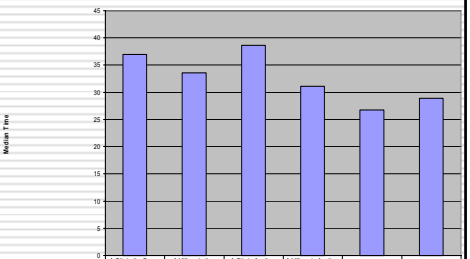
Median Survival Time

Median Survival Time, The Time Lag between Marriage and Giving First Birth Controlling for Migration



	A City in the Same Province	A Village in the Same Province	A City in Another Province	A Village in Another Province	Abroad	Non-Migrant
Median Survival Time (In Month)	34.41	34.43	34.41	34.19	34.5	34.9

Median Survival Time, The Time Lag between First Delivery and Giving Second Birth Controlling for Migration

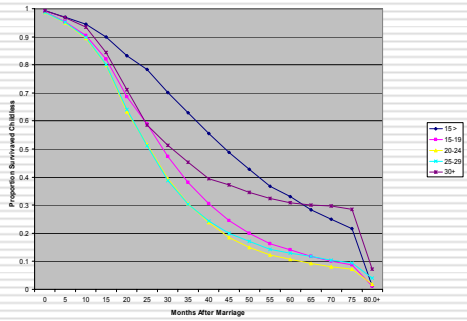


	A City in the Same Province	A Village in the Same Province	A City in Another Province	A Village in Another Province	Abroad	Non-Migrant
Median Survival Time (In Month)	36.94	33.61	38.64	31.1	26.75	28.89

Timing of Birth in Iran

Timing of Birth and Age at Marriage

Life Table Analysis of Giving First Birth: Cumulative Proportion Survived Childless at End of Time t, Controlling for Age at Marriage



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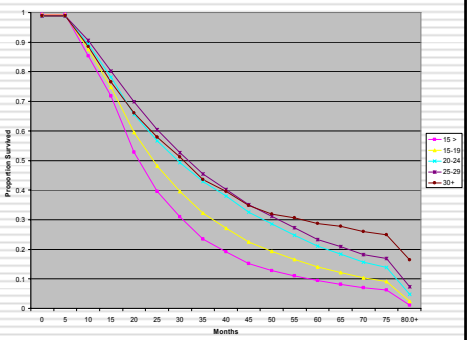
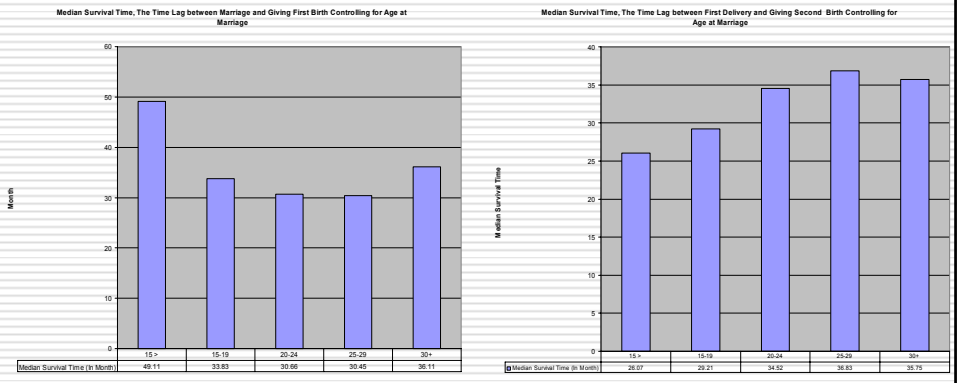


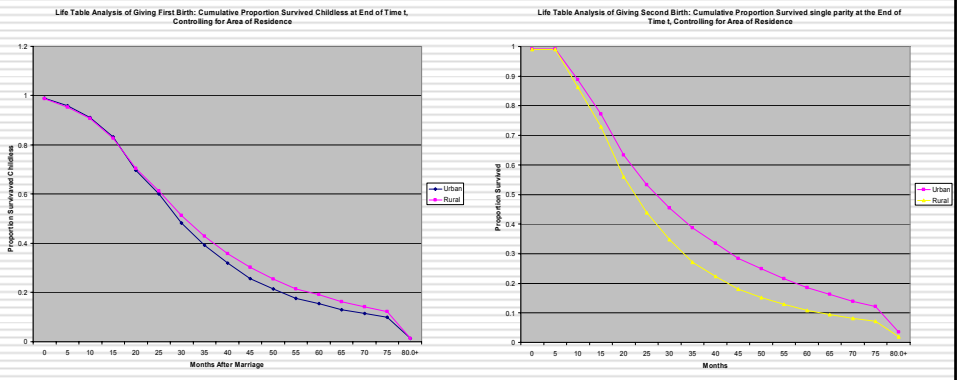
Timing of Birth in Iran

Median Survival Time



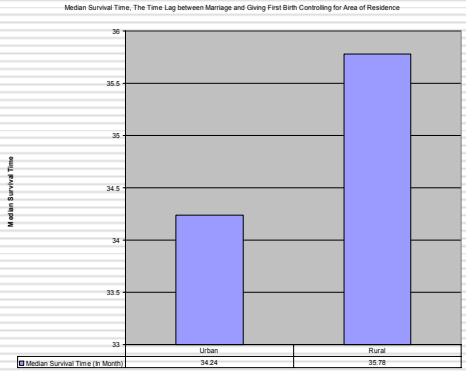
Timing of Birth in Iran

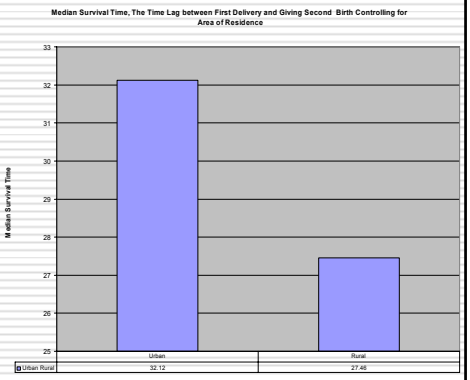
Timing of Birth and Area of Residence



Timing of Birth in Iran

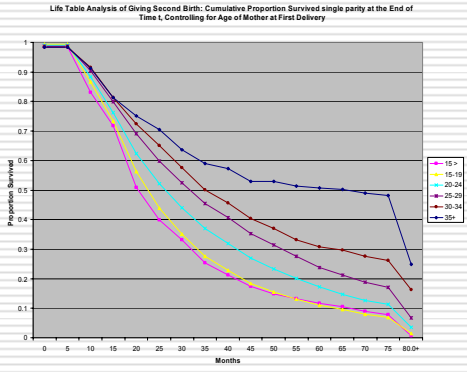
Median Survival Time

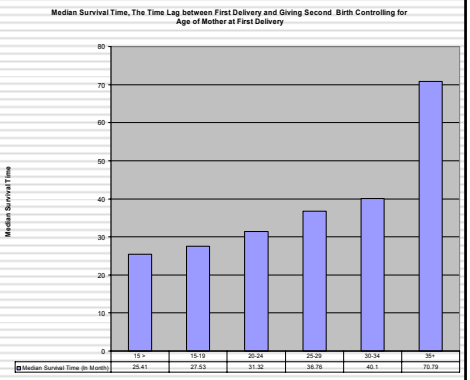




Timing of Birth in Iran

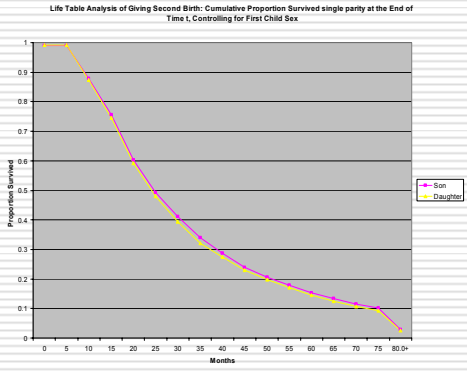
Timing of Birth and Mother's Age at First Delivery

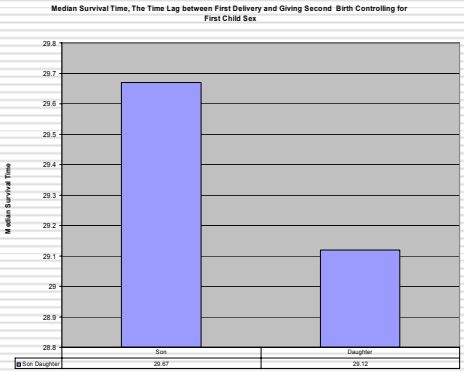




Timing of Birth in Iran

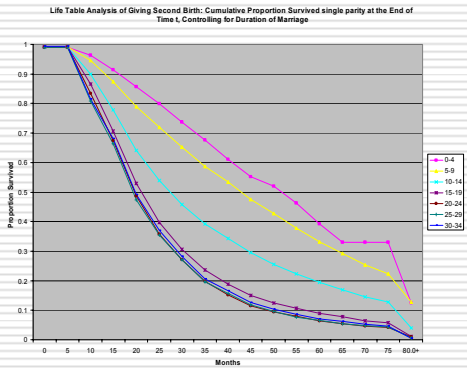
Timing of Birth and First Child Sex

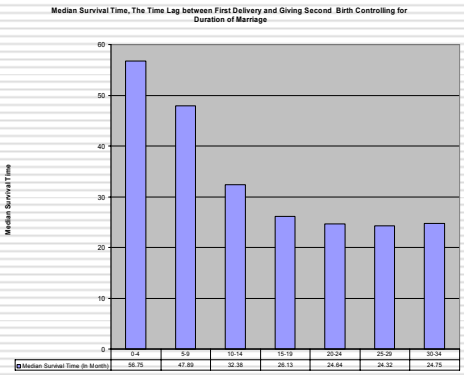




Timing of Birth in Iran

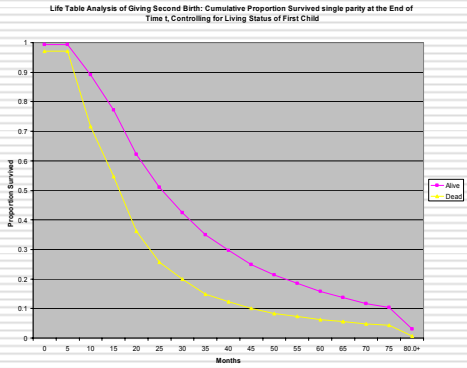
Timing of Birth and Duration of Marriage

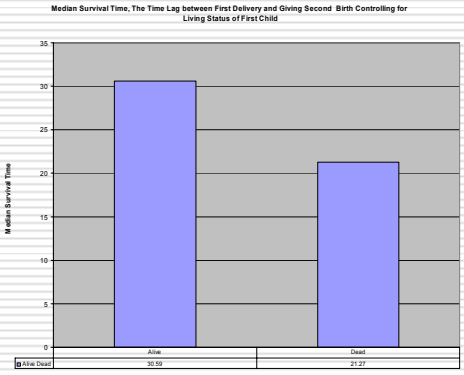




Timing of Birth in Iran

Timing of Birth and Current Living Status of First Child





Inferential Analysis (Bivariate Analysis)

- Cox Regression analyses have been utilized to inquire the impact of socio-demographic variables on birth interval.
- Odds Ratio (Exp. B Values) is used to compare the Odds of giving birth at time T with different categories of socio-demographic variables.

Hazards and Survival Functions in Cox Regression

- The proportional hazards model assumes that the time to event and the covariates are related through the following equation.
- The hazard function is a measure of the potential for the event to occur at a particular time *t*, given that the event did not yet occur. Larger values of the hazard function indicate greater potential for the event to occur.
- The concept of "hazard" may not be intuitive, but it is related to the survival function. The value of the survival function is the probability that the given event has not occurred by time *t*.

Hazard Function:

$$h_i(t) = [h_0(t)]e^{b_0 + b_1 x_{i1} + \ldots + b_p x_{ip}}$$

where

$h_i(t)$	is the hazard for the i^{th} case at time t
$h_0(t)$	is the baseline hazard at time t
p	is the number of covariates
b_j	is the value of the j^{th} regression coefficient
x_{ij}	is the value of the i^{th} case of the j^{th} covariate

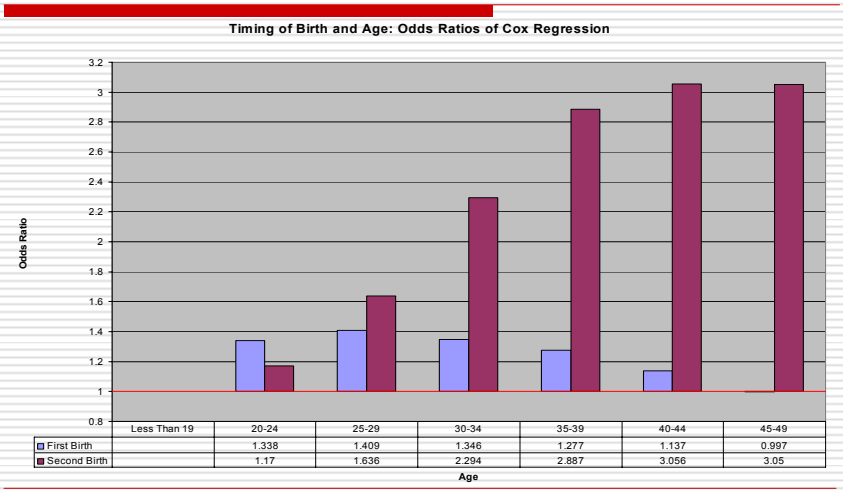
Survival Function:

$$S_i(t) = e^{-\int_0^t [h_0(t)]e^{b_0 + b_1 x_{i1} + \ldots + b_p x_{ip}} dt}$$

where

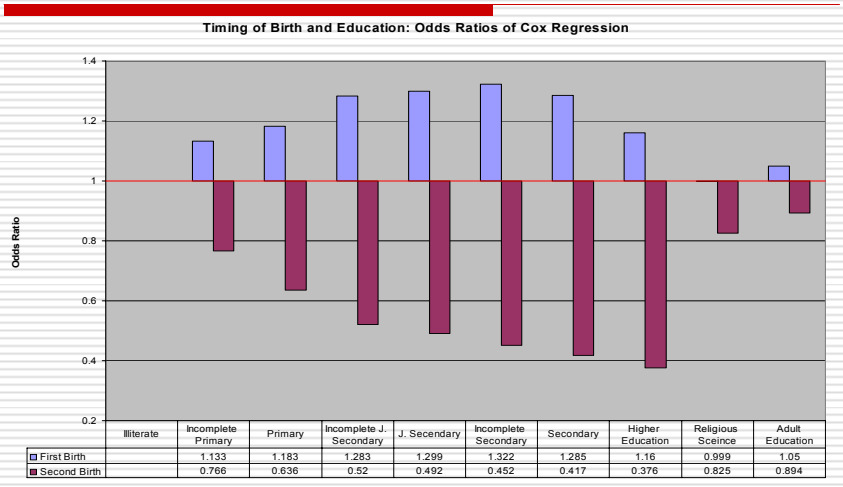
$S_i(t)$	is the probability the i^{th} case survives past time t

Age & Birth Interval



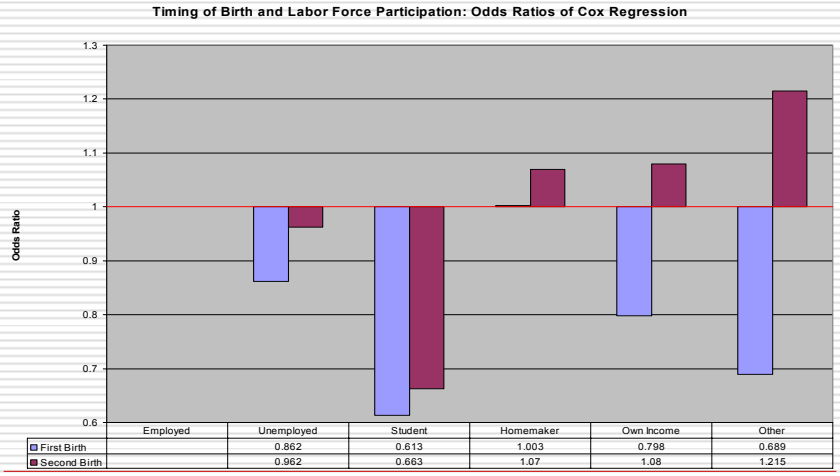
Timing of Birth in Iran

Education & Birth Interval



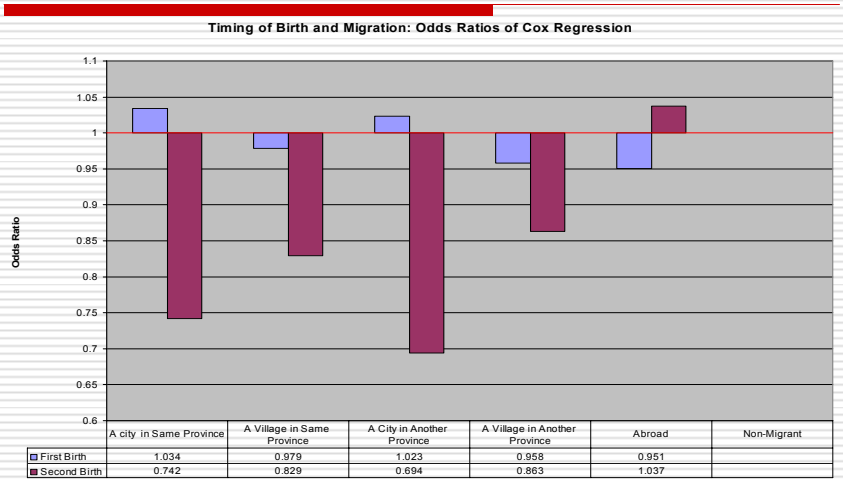
Timing of Birth in Iran

Labor Force Participation & Birth Interval



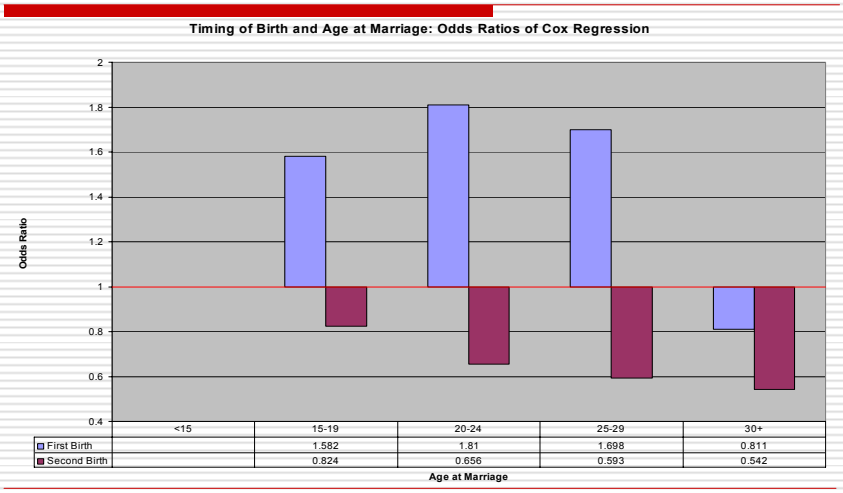
Timing of Birth in Iran

Migration & Birth Interval



Timing of Birth in Iran

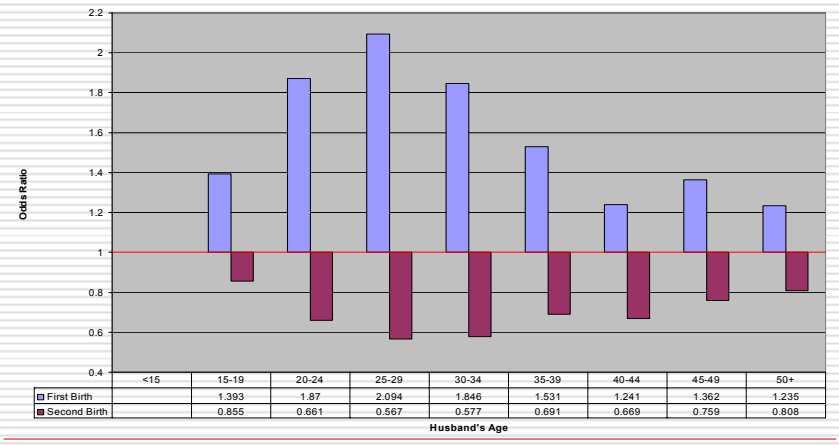
Age at Marriage & Birth Interval



	<15	15-19	20-24	25-29	30+
First Birth		1.582	1.81	1.698	0.811
Second Birth		0.824	0.656	0.593	0.542

Timing of Birth in Iran

Husband's Age at First Marriage of Woman & Birth Interval



	<15	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50+
First Birth		1.393	1.87	2.094	1.846	1.531	1.241	1.362	1.235
Second Birth		0.855	0.661	0.567	0.577	0.691	0.669	0.759	0.808

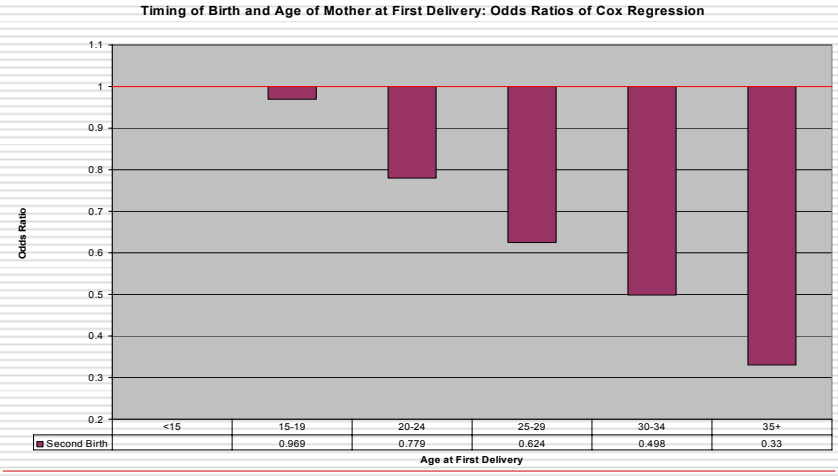
Timing of Birth in Iran

Area of Residence & Birth Interval

Area of Residence	First Birth	Second Birth
Urban	Ref	Ref
Rural	0.922	1.291

Timing of Birth in Iran

Age of Mother at First Birth & Birth Interval

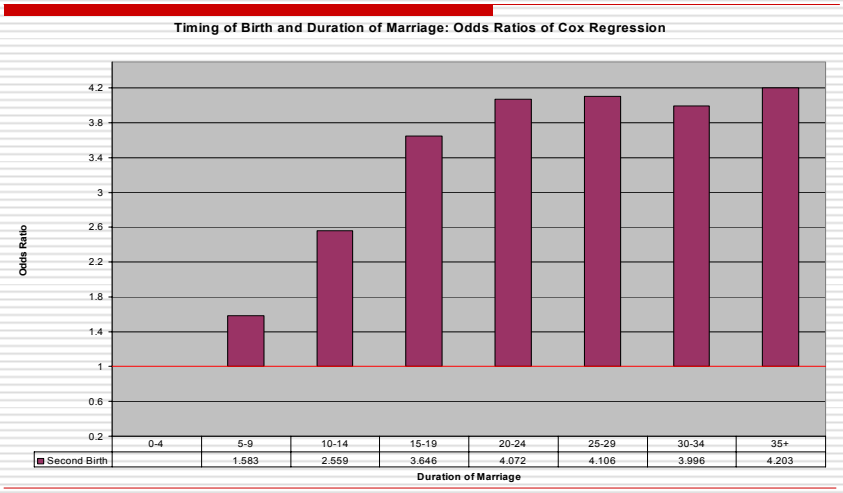


Timing of Birth in Iran

First Child Sex & Birth Interval

First Child Sex	Second Birth
Son	Ref
Daughter	1.036

Duration of Marriage & Birth Interval



Living Status of 1st Child & Birth Interval

Living Status of First Child	Second Birth
Alive	Ref
Dead	1.77

Timing of Birth and Joint Impact of Age and Age at 1st Delivery: Odds Ratio of Cox regression

	Age						
Age of Mother at First Delivery	<19	20-24	25-29	30-34	35-39	40-44	45-49
<15	Ref	Ref	Ref	Ref	Ref	Ref	Ref
15-19	Ref	0.519	0.879	1.304	1.453	1.451	1.375
20-24	Ref	0.328	0.531	0.825	1.212	1.324	1.38
25-29	Ref	**	0.322	0.515	0.779	0.986	1.049
30-34	Ref	**	**	0.425	0.472	0.553	0.891
35+	Ref	**	**	**	0.479	0.342	0.362

Timing of 1st Birth and Joint Impact of Education and Age at Marriage: Odds Ratio of Cox regression

Age at Marriage	Illiterate	Inc. Primary	Primary	Incomplete J. Secondary	J. Secondary	Incomplete Secondary	Secondary	Higher Edu.	Religious Science	Adult Edu.
<15	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
15-19	Ref	1.303	1.34	1.458	1.459	1.404	1.218	1.115	1.035	1.208
20-24	Ref	1.469	1.426	1.477	1.491	1.635	1.542	1.236	1.338	1.391
25-29	Ref	1.322	1.283	1.403	1.247	1.466	1.545	1.403	0.008	1.464
30+	Ref	0.871	0.753	1.162	1.051	0.578	1.008	1.194		0.766

Timing of Birth in Iran

Timing of 2nd Birth and Joint Impact of Education and Age at Marriage: Odds Ratio of Cox regression

Age at Marriage	Illiterate	Inc. Primary	Primary	Inc. J. Secondary	J. Secondary	Inc. secondary	Secondary	Higher Education	Religious Science	Adult Education
<15	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
15-19	Ref	0.816	0.681	0.553	0.521	0.472	0.458	0.44	1.011	0.972
20-24	Ref	0.677	0.586	0.453	0.482	0.485	0.432	0.383	0.516	0.771
25-29	Ref	0.676	0.485	0.463	0.489	0.425	0.413	0.375		0.634
30+	Ref	0.487	0.418	0.686	0.47	0.263	0.29	0.4		0.688

Timing of Birth in Iran

Timing of 1st Birth and Joint Impact of Labor Force Participation and Age at Marriage: Odds Ratio of Cox regression

Labor Force Participation	Age at Marriage <15	15-19	20-24	25-29	30+
Employed	Ref	Ref	Ref	Ref	Ref
Unemployed	Ref	1.134	1.199	1.01	1.305
Student	Ref	0.771	0.666	0.945	0.164
Homemaker	Ref	1.312	1.492	1.365	0.601
Own Income	Ref	1.041	1.289	0.878	1.067
Other	Ref	0.844	1.061	3.277	5.841

Timing of Birth in Iran

Timing of 2nd Birth and Joint Impact of Labor Force Participation and Age at Marriage: Odds Ratio of Cox regression

Labor Force Participation	Age at Marriage <15	15-19	20-24	25-29	30+
Employed	Ref	Ref	Ref	Ref	Ref
Unemployed	Ref	0.914	0.669	0.619	0.206
Student	Ref	0.604	0.321	0.361	0.425
Homemaker	Ref	0.959	0.802	0.763	0.707
Own Income	Ref	1.007	0.711	0.613	0.177
Other	Ref	1.324	0.579	0.906	0.577

Timing of Birth in Iran

Timing of 1st Birth and Joint Impact of Migration and Age at Marriage: Odds Ratio of Cox regression

Age at Marriage	A City in the Same Province	A Village in the Same Province	A City in Another Province	A Village in Another Province	Abroad	Non-Migrant
<15	Ref	Ref	Ref	Ref	Ref	Ref
15-19	1.42	1.484	1.408	1.561	1.488	Ref
20-24	1.579	1.503	1.481	1.408	1.711	Ref
25-29	1.785	1.636	1.501	2.541	1.574	Ref
30+	0.685	1.026	1.144	0.36	0.754	Ref

Timing of Birth in Iran

Timing of 2nd Birth and Joint Impact of Migration and Age at Marriage: Odds Ratio of Cox regression

Age at Marriage	A City in the Same Province	A Village in the Same Province	A City in Another Province	A Village in Another Province	Abroad	Non-Migrant
<15	Ref	Ref	Ref	Ref	Ref	Ref
15-19	0.736	0.65	0.836	1.066	0.919	Ref
20-24	0.629	0.49	0.545	0.7	0.738	Ref
25-29	0.552	0.468	0.633	0.905	0.667	Ref
30+	0.889	0.464	0.71	1.192	0.59	Ref

Timing of Birth in Iran

Timing of 1st Birth and Joint Impact of Area of Residence and Age at Marriage: Odds Ratio of Cox regression

Age at Marriage	Urban	Rural
<15	Ref	Ref
15-19	1.226	Ref
20-24	1.345	Ref
25-29	1.272	Ref
30+	0.694	Ref

Timing of 2nd Birth and Joint Impact of Area of Residence and Age at Marriage: Odds Ratio of Cox regression

Age at Marriage	Urban	Rural
<15	Ref	Ref
15-19	0.801	Ref
20-24	0.615	Ref
25-29	0.56	Ref
30+	0.49	Ref

Inferential Analysis (Multivariate Analysis)

- Demographic and socio-economic characteristics of women including age, education, labor force participation, migration, area of residence and age at marriage entered in the Cox regression model to investigate 1st birth interval dynamics.
- All the above factors also included in another model to investigate 2nd birth dynamics. While another model added such new variables as age of mother at first delivery, first child sex and first child living status.

Multivariate Analysis of Determinants of 1st Birth Interval: Cox Regression Analysis

		First Child	
		Sig.	Exp(B)
Age		0	
	Less Than 19		Ref
	20-24	0	1.23
	25-29	0	1.275
	30-34	0	1.257
	35-39	0	1.226
	40-44	0	1.105
	45-49	0.867	0.996
Education		0	
	Illiterate		Ref
	Incomplete Primary	0.005	1.038
	Primary	0	1.057
	Incomplete J. Secondary	0	1.132
	J. Secondary	0	1.118
	Incomplete Secondary	0	1.12
	Secondary	0.075	1.028
	Higher Education	0	0.92
	Religious Studies	0.531	0.929
	Adult Education	0.121	0.98
Labor Force Participation		0	
	Employed		Ref
	Unemployed	0	0.853
	Student	0	0.594
	Homemaker	0.95	0.999
	Own Income	0.002	0.887
	Other	0.002	0.728
Area of Residence			
	Urban		Ref
	Rural	0	0.964
Migration		0	
	A city in Same Province	0.004	0.949
	A Village in Same Province	0	0.925
	A City in Another Province	0.001	0.93
	A Village in Another Province	0.013	0.892
	Abroad	0.852	0.988
	Non-Migrant		Ref
Age at Marriage		0	
	<15		Ref
	15-19	0	1.537
	20-24	0	1.749
	25-29	0	1.664
	30+	0	0.834

Multivariate Analysis of Determinants of 2nd Birth Interval: Cox Regression Analysis

		Second Child Model II)	
		Sig.	Exp(B)
Age		0	
	Less Than 19		Ref
	20-24	0.004	1.207
	25-29	0	1.793
	30-34	0	2.594
	35-39	0	3.124
	40-44	0	3.106
	45-49	0	2.914
Education		0	
	Illiterate		Ref
	Incomplete Primary	0	0.924
	Primary	0	0.813
	Incomplete J. Secondary	0	0.716
	J. Secondary	0	0.651
	Incomplete Secondary	0	0.604
	Secondary	0	0.543
	Higher Education	0	0.519
	Religious Studies	0.838	0.973
	Adult Education	0.358	0.987
Labor Force Participation		0	
	Employed		Ref
	Unemployed	0.055	0.924
	Student	0.798	0.98
	Homemaker	0.122	1.017
	Own Income	0	0.839
	Other	0.471	1.085
Area of Residence			
	Urban		Ref
	Rural	0	1.082
Migration		0.024	
	A city in Same Province	0.031	0.953
	A Village in Same Province	0.261	0.973
	A City in Another Province	0.006	0.927
	A Village in Another Province	0.516	0.962
	Abroad	0.715	0.976
	Non-Migrant		Ref
Age at Marriage		0	
	<15		Ref
	15-19	0.018	0.974
	20-24	0	0.923
	25-29	0.81	1.007
	30+	0.28	1.066
First Child Sex	Boy		Ref
	Daughter	0	1.035
First Child Living Status			
	Alive		Ref
	Dead	0	1.294
Age of Mother at First Delivery		0	
	<15		Ref
	15-19	0	1.272
	20-24	0	1.106
	25-29	0	0.818
	30-34	0	0.541
	35+	0	0.33

Lessons learnt

- Labor force participation, age at marriage, current age and level of education are more important factors affecting 1st child birth interval. Mean while age, level of education, living status of first child and age of mother at first delivery are more important factors affecting 2nd child birth interval.
- Social pressure to proven fertility causes a short run conjugal patterns irrespective of socio-economic and demographic factors,
- As a result of a such pressure the impact of these factors on first birth interval is much lower than that of second birth. **(Second Child bearing behavior is more rational than first child)**
- women's characteristics are main determinants of birth interval dynamics.
- In general, findings approve other research results.

Limitations

- Lack of longitudinal data enforced us to use cross sectional data.
- The assumption made that the characteristics of sample size were not changed significantly after marriage.
- The intermediate variables should be longitudinal in order to be entered in the model. It is necessary that these variables should refer to the same time as intervals. So the available cross sectional data on proximate variables are not included in the model.