International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

Education and the World's Most Rapid Fertility Decline in Iran

Abbasi-Shavazi, M.J., Lutz, W., Hosseini-Chavoshi, M. and K.C., S.

IIASA Interim Report
May 2008

International Institute for
Applied Systems Analysis
Schlossplatz 1
A-2361 Laxenburg, Austria

Tel: +43 2236 807 342
Fax: +43 2236 71313
E-mail: publications@iiasa.ac.at
Web: www.iiasa.ac.at

Interim Report **IR-08-010**

Education and the World's Most Rapid Fertility Decline in Iran

Mohammad Jalal Abbasi-Shavazi (mabbasi@ut.ac.ir)
Wolfgang Lutz (lutz@iiasa.ac.at)
Meimanat Hosseini-Chavoshi (Meimanat.Hosseini@anu.edu.au)
Samir K.C. (kc@iiasa.ac.at)

Approved by

Sten Nilsson
Acting Director

May 13, 2008

International Institute for Applied Systems Analysis
Registration number: ZVR 524808900

Contents

Abstract

A first analysis of the Iran 2006 census results shows a sensationally low fertility level of 1.9 for the whole country and only 1.5 for the Tehran area (which has about 8 million people). The lowest total fertility rate of 1.3 was recorded for Gilan and Mazandaran provinces. In a recent study, Abbasi-Shavazi and McDonald (2006) emphasized the likely role of greatly improved female education in this trend. However, this hypothesis has not been thoroughly tested and they have not yet provided any formal analysis on this important factor. In the conclusions they express the expectation that fertility in Iran would continue to fall well below replacement level. This paper follows up on the Abbasi-Shavazi and McDonald (2006) paper in two important ways: 1) It presents fertility estimates based on the 2006 census which indicate a substantial further fertility decline; and 2) it presents reconstructions (back to 1970) and projections (to 2030) of the population of Iran by age, sex and level of educational attainment. It decomposes quantitatively to what extent this precipitous fertility decline can be attributed to the rapidly increasing educational attainment of women, and draws more general conclusions for theories of fertility decline.

Acknowledgments

This paper was prepared while Dr. Mohammad Jalal Abbasi-Shavazi visited IIASA and the Vienna Institute of Demography (VID) in March 2008. Financial support from the VID and the Iranian Studies of the Austrian Academy of Sciences is gratefully appreciated. This paper will be presented at the European Population Conference, held in Barcelona, Spain, July 9-12, 2008.

About the Authors

Mohammad Jalal Abbasi-Shavazi is Associate Professor, Department of Demography, University of Tehran, Iran; and Associate, Australian Demographic and Social Research Institute (ADSRI), ANU, Canberra, Australia.

Wolfgang Lutz is Leader of the World Population Program, International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria; and Director, Vienna Institute of Demography of the Austrian Academy of Sciences.

Meimanat Hosseini-Chavoshi is from the Department of Population and Family Health, Ministry of Health, Tehran, Iran; and Fellow, ADSRI, ANU, Canberra, Australia.

Samir K.C. is a Research Scholar with the World Population Program at IIASA, Laxenburg, Austria.

Education and the World's Most Rapid Fertility Decline in Iran

Mohammad Jalal Abbasi-Shavazi, Wolfgang Lutz, Meimanat Hosseini-Chavoshi, and Samir K.C.

1. Introduction

Demographers tend to study all phenomena by age and sex. But there are other human characteristics that show great discriminatory power in explaining differential trends and on which good statistical information is available. Education is a prime candidate for this and it has been shown that explicitly considering education as a source of observed heterogeneity can add greatly to understanding the forces driving a phenomenon, in this case a very rapid fertility decline.

It is very common to associate changes in the education levels of women with changes in fertility levels. It is so conventional, in fact, that education plays a role in almost all theoretical approaches to the fertility transition. Education is said to provide access to modern ways of thinking, to provide confidence to engage in the modern world, to reduce infant and child mortality, to stimulate higher levels of gender equity within couple relationships, and to promote labor force participation of women in the cash economy, hence raising the opportunity cost of having children. The education of women may also lead to a greater emphasis on their part on the 'quality' of children as opposed to the quantity of children. Finally, education is a broad indicator of societal modernization (Lucas and Meyer 1994: 63-64). According to Cochrane (1979: 147) women's education is likely to raise the age at marriage and, in some countries, to reduce the probability of ever marrying. Cochrane (1979: 9) noted that education is positively related to more favorable attitudes towards birth control, a greater knowledge of contraception, and husband-wife communication. Caldwell (1982: 315-320) stated that education influences fertility by a) reducing the benefits from children's work, b) increasing the costs of children, c) increasing the importance of the investment nature of children, d) speeding cultural change, and e) propagating Western middle-class values. As education levels increase, the educated woman is very likely to be married to an educated man and to be living in an educated society (Abbasi-Shavazi et al. 2003).

Education can be divided broadly into formal (through schooling) and informal (acquiring knowledge from various sources, including media, face to face contacts, etc). One of the main social changes in the 20th century and particularly over the past two decades has been the expansion of mass (formal) education in Iran. The literacy rate has increased dramatically in both urban and rural areas (Table 1). For example, the literacy rate for women aged 15-19 in urban areas increased from around 57 percent in 1966 to around 97 percent (almost universal) in 1996. The improvement in rural areas has been more dramatic, increasing from only 5 percent in 1966 to 86 percent in 1996. In 2006,

around 98 percent of women aged 20-24 and 96 percent of women aged 25-29 in urban areas were literate as compared with 90 and 84 percent in rural areas, respectively.

Table 1. The literacy rate for women aged 15-19 to 25-29, Iran, by rural and urban areas. Sources: Statistical Centre of Iran; various censuses.

Age groups	*1966*		*1976*		*1986*		*1996*		***2006***	
	Urban	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*
15-19	57.7	5.4	75.4	19.8	85.8	53.0	96.9	86.4	98.3	93.2
20-24	41.2	2.7	59.4	10.1	75.8	36.5	93.8	77.9	97.9	90.5
25-29	29.5	1.4	49.4	4.9	65.5	22.0	89.5	65.4	96.3	84.1

In 1998, around 52 percent of those admitted to government universities were girls. The figure increased to 57 percent in 1999 and then to around 65 percent in 2007. These increases in educational attainment for Iranian girls mean that marriage and childbearing are often delayed into the early twenties. Studies suggest that aspirations and expectations of women in post-revolutionary Iran have also risen considerably (Shadi-Talab 2005; Abdollahyan 2004; Mir-Hosseini 2002; Kian-Thiebaut 2002). This has led to the improvement of the status of women at least within the family, and women have increased their role in family decision making. Increased literacy has contributed to women's confidence and has increased women's perceptions that they have options in many aspects of their lives, particularly women in rural areas who had been much constrained by past gender inequities (Hoodfar 1996: 35). Maternal education has also contributed to the reduction of infant mortality (Caldwell 1989; Cleland 1990), a factor which is conducive to higher child survival, and thus, reduces the demand for children.

In addition to formal schooling, informal education and knowledge has indirectly contributed to the reduction of fertility in Iran. The legitimization of family planning in post-revolutionary Iran paved the way for printing family planning brochures, teaching population education in high schools, holding workshops for young couples and other educational campaigns by the mass media. The rise in access to electricity, TV, radio, and transport and communication in remote areas of Iran has also increased knowledge and information of families at large. By 1996, the majority of rural communities had access to electricity, TV, radio and piped water (Abbasi-Shavazi 2000). The Literacy Movement was another organization created after the Revolution, aiming to instruct all illiterates above 10 years of age. The organization began its task in 1979 by dispatching volunteer school graduates as teachers to the villages. There were also some classes to instruct illiterate employees under 50 working in government offices, factories and workshops. The establishment of a health network system and health houses in rural areas diffused the idea of small family size and family planning. The system employed local girls and boys as health officers, *Behvarz*, who have had regular face-to-face contacts with women of childbearing ages to provide them with family planning information and services. The compulsory pre-marriage counseling was another way by which newly married couples have been able to gain information on

contraceptives, STDs, and other issues related to maternal and child health care. In this paper, our main focus is on the impact of formal education and expansion of schooling on fertility decline in Iran.

2. Reconstructing and projecting the changing educational composition by age and sex

IIASA, in collaboration with the Vienna Institute of Demography, has recently produced a unique new data set which applies demographic multi-state projection techniques to reconstruct the population by age, sex and level of educational attainment from empirical data around 2000 back to 1970 in five-year steps. This has been done for 120 countries, including Iran. While a comprehensive description of methods and results is given in Lutz et al. (2007), in the following section we will provide a brief outline of the approach and highlight the results for Iran. The same methodology is currently being applied to project the population by levels of educational attainment to 2030 (K.C. et al. 2008), and the first results for Iran are included here.

At any point in time the distribution of the population by age, sex and level of educational attainment reflects the history of changes in the proportions of a cohort that attended school and reached certain educational levels. Since formal education typically happens in childhood and youth, the current educational attainment distribution of 50-54 year old women, for instance, reflects education conditions and school enrolment of more than 30 years ago. This is clearly visible in Figure 1 for the educational age pyramid of Iran around 2000 (as estimated from the 1996 census). The figure gives the usual age pyramid with men on the left and women on the right, where colors (shading) indicate a further subdivision for each age-group of men and women by highest level of educational attainment. The picture clearly indicates that younger Iranians are not only much more numerous (due to the history of very high fertility), but also on average much better educated than older ones. This recent improvement in educational attainment is particularly impressive for women. While more than two-thirds of the young women in Iran today have completed at least junior secondary education, among their mothers' generation only a tiny fraction did so. Hence, the history of rapidly increasing education over time is well reflected in today's age pattern of education.

The back-projection exercise described here utilizes the fact that much of a population's education history is still reflected in its current structure (see Figure 2). It goes back along cohort lines in five-year steps by deriving, e.g., the proportion without any formal schooling among 50-54 year old women in 1995 from that of 55-59 year olds in 2000. There are only three possible factors that can cause these two proportions to differ: differential mortality, differential migration, and women who still acquire formal education after the age of 55. While such late educational transitions are typically irrelevant, differential mortality is a major issue because there is strong evidence in virtually all countries where such data exist that higher educational groups have significantly lower levels of mortality, presumably through better access to information, healthier lifestyles and better economic standing. Although this issue is mentioned in the economic literature of education data, it is not explicitly dealt with when reconstructing human capital data. Only demographic multi-state methods can appropriately deal with differential vital rates.

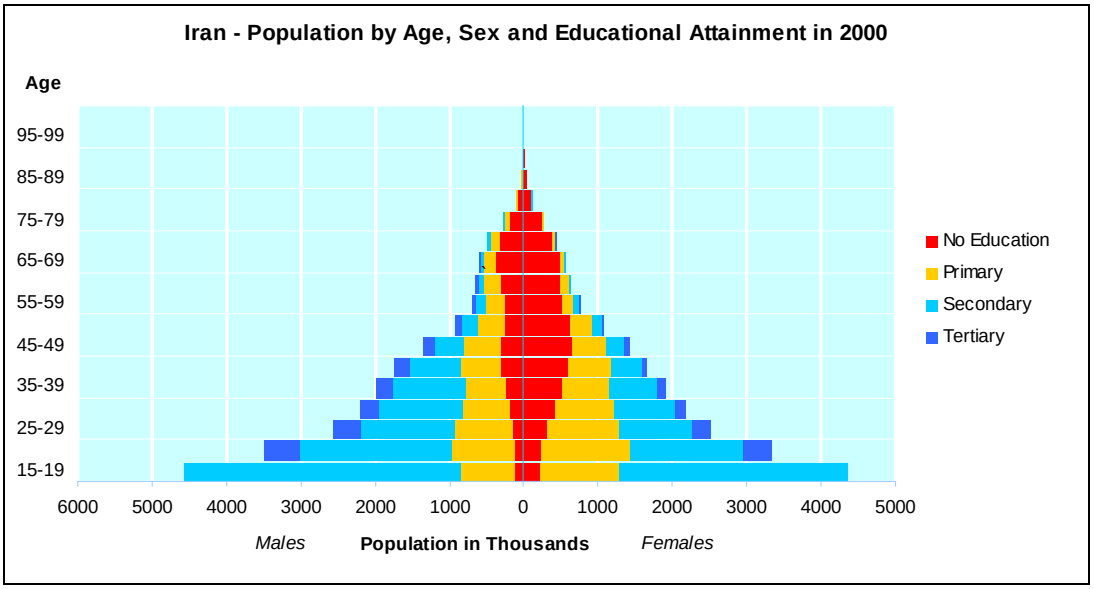

Figure 1. Age and education pyramid for Iran, 2000.

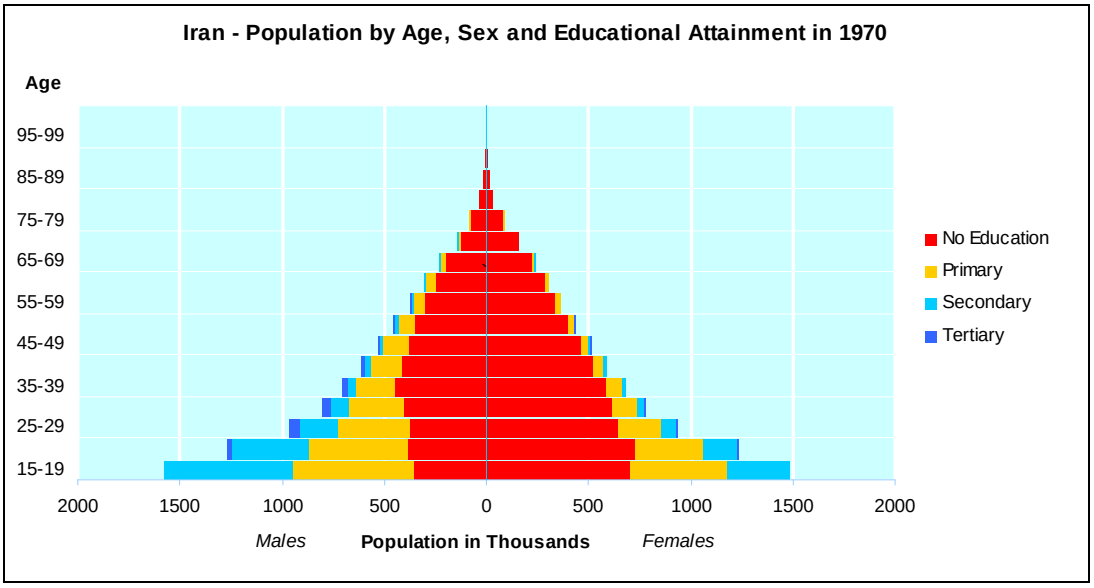

Figure 2. Reconstructed age and education pyramid for Iran, 1970.

Lutz et al. (2007) provide a detailed account of all the specific assumptions that had to be made as part of this reconstruction exercise, discuss their plausibility, and provide sensitivity analyses. The method can be summarized as follows: First, for every country, an empirical distribution of the population by age, sex and four categories of educational attainment (no formal education, some primary, completed lower secondary, completed first level of tertiary) was retrieved for a year close to 2000. In the case of Iran, the data were taken from the 1996 census and projected forward to 2000. We will update these figures based on the 2006 census later. Second, we drew on an existing United Nations (2005) dataset which provides estimates of the age and sex

structure in five-year intervals since 1950 for every country in the world. For this reason our effort did not have to reconstruct the absolute sizes of the populations by individual age groups, but only the proportions with different education levels in each age group of men and women. This also made the necessary demographic assumptions a lot easier, since it was not necessary to estimate the overall level of mortality or the total volume of migration (which is implicit in the UN estimates), but only to consider to what degree these demographic forces differ by level of education. While for migration the default assumption was that there are no educational differentials, for mortality we assumed a consistent pattern that life expectancy at age 15 differs by five years between the lowest and the highest educational category (with the difference between no education and some primary being one year and the other differences being two years each). This assumption was based on an assessment of a selection of countries from different parts of the world for which such data exist.

A further problem arises from the fact that in the empirical data, the oldest age group is typically an open-ended category such as 65+ or 70+. When going back along cohort lines, those aged 70+ in 2000 are 40+ in 1970. To get information for the closed intervals 40-44 to 60-64, we need to make assumptions about the distributions across age and education categories in these open intervals which were based (unless empirical information was available) on exponential trend extrapolation of the proportions in the adjacent closed age groups. This source of uncertainty is the reason why it was decided to stop the reconstruction in 1970 and not go back further into history, as the assumptions would have become progressively more restrictive. Another set of assumptions referred to the ages at which transitions from one educational category to another were made. Since the reconstruction is only performed for the population above age 15, this only concerned transitions to tertiary and to a lesser extent to the secondary level. Lutz et al. (2007) provide further technical details on the reconstruction of the dataset.

Table 2 provides the numerical output for the reconstruction for Iran. It shows the absolute numbers of men and women as well as the total population by five-year age groups and the four levels of educational attainment for Iran. It also gives the corresponding proportions among all people in the corresponding age group. The bottom line of each table gives the distribution across educational categories for all adult age groups together; the right-hand margin gives the summary measure of the average level of education for individual age groups in the form of mean years of schooling. Although the estimation of this indicator requires additional assumptions in terms of the average years of schooling it takes to become a member of a certain educational attainment category, it was decided to provide it in order to facilitate a comparison to other datasets that only provide mean years of schooling. Finally, the number in the lower right corner of the matrix gives the mean year of schooling for the entire adult population above age 25. This is the number most frequently used in economic studies. Although most often used by economists, this single number has only limited information content and even in terms of mean years of schooling hides the significant improvement in the educational level of younger Iranian women. Having the full matrix available significantly expands the possibility for analysis not only along the age dimension but also with respect to different mixes of primary, secondary and tertiary education in the population. This information will also be used in the section on decomposition below.

Table 2. Results of the reconstruction of the population by age, sex and level of educational attainment, Iran, from 2000 back to 1970.

Iran

Population Distribution ('000) by Age, Sex and Level of Education plus Mean Years of Schooling

	Males					Females				
	No Edu.	Primary	Secondary	Tertiary	MYS	No Edu.	Primary	Secondary	Tertiary	MYS
2000 15-19	119.3	726.3	3702.1	0.0	**8.7**	209.6	1059.4	3073.0	0.0	**8.0**
20-24	133.1	835.0	2032.3	495.5	**9.1**	248.6	1166.8	1529.4	396.1	**7.9**
25-29	148.0	765.5	1283.5	369.2	**8.6**	317.8	972.6	979.6	236.2	**7.0**
30-34	181.6	643.6	1113.0	268.1	**8.2**	416.2	809.2	806.6	138.5	**6.2**
35-39	231.5	558.5	969.7	234.4	**7.9**	508.0	643.4	643.8	110.9	**5.6**
40-44	301.7	557.9	680.9	191.7	**7.3**	603.6	562.5	410.1	74.5	**4.8**
45-49	302.4	498.5	390.3	163.7	**6.9**	659.7	455.3	236.0	62.7	**4.0**
50-54	268.5	354.6	200.8	97.9	**6.0**	636.8	290.9	122.7	34.5	**3.0**
55-59	263.6	258.2	116.6	60.1	**5.0**	513.7	163.5	58.9	16.0	**2.2**
60-64	315.9	214.4	71.1	37.0	**3.8**	493.5	102.6	29.5	7.2	**1.4**
65+	1009.8	386.9	86.3	45.4	**2.3**	1239.6	135.9	33.2	6.2	**0.8**
15+	*3275.3*	*5799.4*	*10646.6*	*1963.0*	***7.6***	*5846.9*	*6362.0*	*7922.7*	*1082.9*	***5.8***
25+	*3022.9*	*4238.0*	*4912.2*	*1467.5*	***6.8***	*5388.7*	*4135.9*	*3320.3*	*686.8*	***4.6***
1995 15-19	135.8	563.0	2869.6	0.0	**8.6**	252.5	805.0	2335.2	0.0	**7.8**
20-24	152.4	618.4	1505.1	366.9	**8.9**	324.5	843.3	1105.3	286.3	**7.5**
25-29	187.1	660.4	1107.3	318.5	**8.3**	425.3	796.7	802.5	193.5	**6.4**
30-34	239.2	575.7	995.5	239.8	**7.9**	520.4	657.8	655.7	112.6	**5.6**
35-39	311.8	575.0	698.1	195.7	**7.2**	618.4	574.9	417.3	75.5	**4.8**
40-44	314.5	516.5	401.7	167.5	**6.8**	677.4	466.2	240.4	63.6	**4.0**
45-49	283.4	372.5	209.2	101.2	**6.0**	658.5	299.8	125.6	35.2	**3.0**
50-54	284.5	277.1	123.8	63.1	**5.0**	537.9	170.5	60.9	16.5	**2.2**
55-59	350.8	236.3	77.2	39.7	**3.7**	527.1	109.0	30.9	7.5	**1.4**
60-64	438.2	192.8	47.4	25.2	**2.6**	536.8	70.1	16.5	3.7	**0.9**
65+	936.6	310.5	59.6	29.4	**1.9**	1075.5	97.4	23.6	3.3	**0.6**
15+	*3634.3*	*4898.2*	*8094.5*	*1547.1*	***7.1***	*6154.3*	*4890.7*	*5814.0*	*797.6*	***5.2***
25+	*3346.1*	*3716.8*	*3719.9*	*1180.2*	***6.2***	*5577.3*	*3242.4*	*2373.4*	*511.4*	***4.0***
1990 15-19	166.6	675.2	2038.1	0.0	**8.0**	343.3	890.9	1466.0	0.0	**6.7**
20-24	210.7	742.5	1478.3	118.7	**7.7**	458.4	857.3	998.9	69.0	**6.0**
25-29	261.0	626.7	1166.4	172.9	**7.6**	554.4	699.3	734.3	79.3	**5.5**
30-34	333.0	612.5	740.5	206.8	**7.2**	654.1	606.7	438.6	79.1	**4.8**
35-39	330.4	540.9	418.4	173.7	**6.8**	711.3	488.4	250.7	66.1	**4.0**
40-44	299.3	391.9	218.6	105.1	**6.0**	690.4	313.4	130.6	36.4	**3.0**
45-49	300.9	291.6	129.1	65.3	**5.0**	558.6	176.4	62.6	16.8	**2.2**
50-54	374.5	250.7	81.0	41.2	**3.7**	540.3	111.2	31.3	7.5	**1.4**
55-59	475.6	207.6	50.3	26.4	**2.6**	556.4	72.2	16.8	3.8	**0.9**
60-64	467.0	174.7	36.4	18.1	**2.2**	489.2	52.1	12.3	2.0	**0.7**
65+	771.7	215.8	35.0	16.0	**1.6**	882.8	64.7	15.3	1.5	**0.5**
15+	*3990.7*	*4730.2*	*6392.3*	*944.3*	***6.3***	*6439.0*	*4332.6*	*4157.3*	*361.6*	***4.3***
25+	*3613.3*	*3312.6*	*2875.8*	*825.6*	***5.5***	*5637.3*	*2584.5*	*1692.4*	*292.6*	***3.3***
1985 15-19	212.1	746.0	1599.8	0.0	**7.3**	460.7	860.2	1068.4	0.0	**5.8**
20-24	262.4	629.0	1281.3	57.5	**7.2**	557.1	701.4	786.5	26.3	**5.3**
25-29	334.9	614.7	808.7	137.3	**7.0**	658.4	609.3	465.0	52.6	**4.6**
30-34	333.3	544.2	418.9	173.2	**6.8**	718.4	492.1	251.4	66.0	**4.0**
35-39	303.6	396.2	219.6	105.1	**5.9**	700.1	317.0	131.5	36.5	**3.0**
40-44	308.6	297.9	130.9	65.8	**4.9**	569.7	179.4	63.3	16.9	**2.2**
45-49	391.4	260.8	83.5	42.1	**3.7**	556.7	114.2	31.9	7.6	**1.4**
50-54	510.7	221.7	53.1	27.5	**2.6**	583.0	75.4	17.4	3.9	**0.9**
55-59	521.7	193.8	39.8	19.5	**2.1**	527.6	55.9	13.1	2.1	**0.7**
60-64	441.6	139.5	24.5	11.3	**1.8**	436.6	37.8	8.9	1.1	**0.6**
65+	615.3	142.3	19.1	8.0	**1.3**	740.5	43.7	9.9	0.7	**0.4**
15+	*4235.5*	*4186.0*	*4679.1*	*647.4*	***5.6***	*6508.7*	*3486.3*	*2847.3*	*213.7*	***3.6***
25+	*3761.1*	*2811.0*	*1798.0*	*589.9*	***4.7***	*5490.9*	*1924.7*	*992.3*	*187.4*	***2.6***
1980 15-19	250.8	600.2	1273.3	0.0	**7.1**	538.6	676.7	781.8	0.0	**5.2**
20-24	314.3	575.6	839.4	42.6	**6.6**	624.9	577.0	471.5	16.5	**4.5**
25-29	315.0	513.0	447.0	107.9	**6.6**	684.3	467.4	258.5	41.5	**3.9**
30-34	289.3	376.5	207.6	98.9	**5.9**	679.7	306.8	126.6	34.9	**3.0**
35-39	302.1	290.6	126.9	63.4	**4.9**	577.3	181.3	63.6	16.9	**2.2**
40-44	389.8	258.6	82.1	41.1	**3.6**	569.8	116.5	32.4	7.7	**1.4**
45-49	509.3	219.9	52.1	26.8	**2.5**	578.7	74.5	17.0	3.8	**0.9**
50-54	519.5	191.8	38.9	18.9	**2.1**	524.8	55.3	12.8	2.1	**0.7**
55-59	446.4	139.9	24.2	11.0	**1.8**	448.4	38.6	8.9	1.1	**0.6**
60-64	325.8	86.1	12.6	5.4	**1.4**	357.7	25.1	5.7	0.5	**0.5**
65+	517.8	98.1	10.8	4.1	**1.0**	641.4	30.4	6.6	0.3	**0.3**
15+	*4180.3*	*3350.3*	*3115.0*	*420.1*	***4.9***	*6225.7*	*2549.6*	*1785.3*	*125.2*	***3.0***
25+	*3615.1*	*2174.5*	*1002.2*	*377.5*	***3.8***	*5062.2*	*1295.9*	*532.1*	*108.7*	***1.9***
1975 15-19	317.0	579.4	884.8	0.0	**6.4**	630.4	580.8	489.4	0.0	**4.4**
20-24	316.8	514.8	518.4	35.8	**6.2**	690.5	470.5	286.6	13.8	**3.8**
25-29	290.2	376.6	239.4	65.4	**5.7**	686.8	309.2	138.6	23.3	**2.9**
30-34	304.3	291.8	126.7	63.0	**4.9**	585.1	183.1	63.9	16.9	**2.2**
35-39	397.0	262.5	82.8	41.2	**3.6**	580.7	118.4	32.7	7.7	**1.4**
40-44	526.3	226.2	53.2	27.1	**2.5**	594.4	76.3	17.3	3.8	**0.9**
45-49	547.5	201.0	40.4	19.4	**2.1**	545.5	57.3	13.2	2.1	**0.7**
50-54	483.8	150.7	25.7	11.6	**1.7**	475.4	40.7	9.3	1.1	**0.6**
55-59	367.8	96.5	13.9	5.9	**1.4**	392.5	27.3	6.1	0.5	**0.5**
60-64	260.0	57.2	6.9	2.7	**1.2**	309.8	17.5	3.8	0.2	**0.4**
65+	480.7	76.0	6.9	2.4	**0.8**	579.8	22.3	4.5	0.2	**0.3**
15+	*4291.4*	*2832.7*	*1999.0*	*274.5*	***4.1***	*6070.7*	*1903.5*	*1065.5*	*69.6*	***2.3***
25+	*3657.6*	*1738.5*	*595.9*	*238.7*	***3.0***	*4749.9*	*852.2*	*289.5*	*55.8*	***1.3***
1970 15-19	360.9	585.3	627.8	0.0	**6.1**	703.3	478.1	303.9	0.0	**3.7**
20-24	380.5	492.6	368.2	28.3	**5.3**	732.7	328.9	163.0	8.2	**2.8**
25-29	375.3	358.9	180.6	51.2	**4.7**	648.5	202.4	76.4	12.3	**2.1**
30-34	407.7	268.6	84.2	41.7	**3.6**	612.8	124.5	34.2	8.0	**1.4**
35-39	446.4	191.1	44.6	22.6	**2.5**	586.5	75.0	16.9	3.7	**0.9**
40-44	416.2	152.1	30.3	14.5	**2.1**	520.8	54.5	12.5	2.0	**0.7**
45-49	384.7	119.2	20.1	9.0	**1.7**	461.3	39.4	8.9	1.0	**0.6**
50-54	344.8	89.9	12.8	5.3	**1.4**	401.5	27.8	6.2	0.5	**0.5**
55-59	295.7	64.5	7.7	3.0	**1.2**	343.3	19.3	4.1	0.3	**0.4**
60-64	252.5	45.9	4.6	1.6	**0.9**	293.2	13.3	2.8	0.1	**0.3**
65+	440.9	58.3	4.4	1.4	**0.7**	521.2	16.4	3.1	0.1	**0.2**
15+	*4105.6*	*2426.6*	*1385.5*	*178.6*	***3.6***	*5825.1*	*1379.5*	*632.1*	*36.2*	***1.8***
25+	*3364.2*	*1348.6*	*389.4*	*150.3*	***2.5***	*4389.1*	*572.5*	*165.1*	*28.1*	***1.0***

Using the method of multi-state population projections, several alternative scenarios have been calculated for Iran (K.C. et al. 2008). In the following we will focus only on the so-called "UN Scenario" which defines education-specific fertility and mortality rates in such a way that it replicates the overall fertility and mortality rates of the medium variant of the UN population projections. This implies that the education pyramid given in Figure 3 has an identical overall shape to the one resulting from the UN medium variant, and only the age- and sex-specific proportions with different levels of educational attainment have been added as additional pieces of information. For the age- and sex-specific probabilities of transitions to higher educational categories, this scenario assumes a continuation of the trend observed over the past two decades.

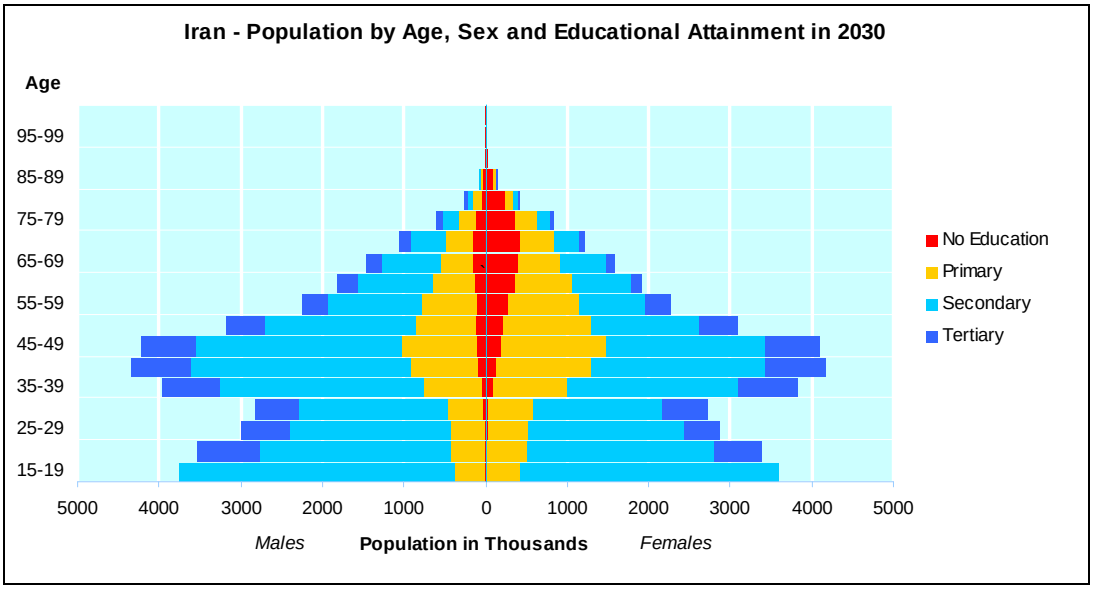

Figure 3. Projected age and education pyramid for Iran, 2030.

Figure 3 conveys the educational structure of a highly developed industrialized country with high proportions of the population having secondary or higher education. Particularly among younger adults in 2030 there will be virtually no uneducated persons left and only a few will remain with primary school as their highest attainment (see also Table 3). The overall shape of the age pyramid is rather unusual as a consequence of the very large cohorts that were born in the 1980s and who will be 40-50 years old in 2030.

Table 3. Results of the projections (according to the "UN Scenario") of the population by age, sex and level of educational attainment, Iran, 2000 to 2030.

Iran

Population Distribution ('000) by Age, Sex and Level of Education plus Mean Years of Schooling

		Males					Females				
		No Edu.	Primary	Secondary	Tertiary	MYS	No Edu.	Primary	Secondary	Tertiary	MYS
2000	15-19	119.3	726.3	3702.1	0.0	**8.7**	209.6	1059.4	3073.0	0.0	**8.0**
	20-24	133.1	835.0	2032.3	495.5	**9.1**	248.6	1166.8	1529.4	396.1	**7.9**
	25-29	148.0	765.5	1283.5	369.2	**8.6**	317.8	972.6	979.6	236.2	**7.0**
	30-34	181.6	643.6	1113.0	268.1	**8.2**	416.2	809.2	806.6	138.5	**6.2**
	35-39	231.5	558.5	969.7	234.4	**7.9**	508.0	643.4	643.8	110.9	**5.6**
	40-44	301.7	557.9	680.9	191.7	**7.3**	603.6	562.5	410.1	74.5	**4.8**
	45-49	302.4	498.5	390.3	163.7	**6.9**	659.7	455.3	236.0	62.7	**4.0**
	50-54	268.5	354.6	200.8	97.9	**6.0**	636.8	290.9	122.7	34.5	**3.0**
	55-59	263.6	258.2	116.6	60.1	**5.0**	513.7	163.5	58.9	16.0	**2.2**
	60-64	315.9	214.4	71.1	37.0	**3.8**	493.5	102.6	29.5	7.2	**1.4**
	65+	1009.8	386.9	86.3	45.4	**2.3**	1239.6	135.9	33.2	6.2	**0.8**
	15+	*3275.3*	*5799.4*	*10646.6*	*1963.0*	***7.6***	*5846.9*	*6362.0*	*7922.7*	*1082.9*	***5.8***
	25+	*3022.9*	*4238.0*	*4912.2*	*1467.5*	***6.8***	*5388.7*	*4135.9*	*3320.3*	*686.8*	***4.6***
2005	15-19	89.3	889.0	3555.4	0.0	**8.6**	145.4	1192.4	2972.5	0.0	**7.9**
	20-24	116.0	970.9	2665.8	682.3	**9.4**	204.7	1341.7	2173.6	527.5	**8.4**
	25-29	129.1	811.4	1977.2	484.8	**9.1**	242.4	1138.6	1527.0	355.1	**7.8**
	30-34	143.6	744.0	1281.3	329.0	**8.5**	309.7	949.0	844.9	343.8	**7.3**
	35-39	176.3	625.7	1084.6	261.8	**8.2**	405.6	789.8	789.0	135.8	**6.2**
	40-44	224.1	541.8	943.9	228.7	**8.1**	494.1	627.1	629.4	108.7	**5.9**
	45-49	289.8	537.6	659.5	186.4	**7.7**	584.0	545.8	399.6	72.9	**5.0**
	50-54	285.9	473.6	374.0	158.0	**7.0**	632.9	438.7	228.8	61.2	**4.1**
	55-59	246.9	328.6	188.7	93.0	**6.1**	603.3	277.3	118.0	33.5	**3.1**
	60-64	233.0	230.8	106.4	55.8	**5.1**	474.7	152.5	55.7	15.4	**2.3**
	65+	921.2	447.9	125.6	68.0	**3.0**	1294.1	192.5	52.5	11.9	**1.1**
	15+	*2855.4*	*6601.3*	*12962.3*	*2547.9*	***8.1***	*5390.8*	*7645.3*	*9791.0*	*1665.6*	***6.4***
	25+	*2650.0*	*4741.3*	*6741.1*	*1865.6*	***7.5***	*5040.7*	*5111.2*	*4644.9*	*1138.1*	***5.5***
2010	15-19	59.0	716.3	3328.3	0.0	**8.8**	87.6	935.2	2877.7	0.0	**8.3**
	20-24	88.0	878.0	2768.5	742.0	**9.7**	143.8	1180.9	2374.8	568.7	**8.9**
	25-29	114.2	957.0	2633.4	673.5	**9.4**	202.4	1327.7	2183.8	492.7	**8.4**
	30-34	127.0	799.1	1952.1	478.3	**9.1**	239.4	1125.3	1373.5	489.6	**8.1**
	35-39	141.0	731.2	1262.2	324.7	**8.5**	305.1	935.8	834.7	340.1	**7.3**
	40-44	172.4	613.0	1066.1	257.9	**8.4**	398.5	777.1	778.4	134.2	**6.5**
	45-49	217.6	527.4	923.3	224.6	**8.6**	483.1	614.6	619.2	107.3	**6.2**
	50-54	277.1	516.5	638.9	181.8	**7.8**	566.8	531.5	391.4	71.7	**5.1**
	55-59	266.6	445.0	356.1	152.0	**7.1**	607.8	423.3	222.7	60.0	**4.1**
	60-64	222.1	298.9	175.1	87.8	**6.2**	568.2	263.1	113.5	32.6	**3.1**
	65+	779.5	507.4	188.7	103.3	**3.9**	1324.8	284.9	93.9	24.9	**1.6**
	15+	*2464.4*	*6989.8*	*15292.5*	*3225.9*	***8.5***	*4927.5*	*8399.3*	*11863.6*	*2321.8*	***7.0***
	25+	*2317.4*	*5395.5*	*9195.8*	*2483.9*	***8.2***	*4696.2*	*6283.3*	*6611.2*	*1753.1*	***6.4***
2015	15-19	29.2	446.0	2415.2	0.0	**8.9**	38.6	565.1	2148.9	0.0	**8.6**
	20-24	58.1	707.4	2563.9	722.3	**10.0**	86.6	926.0	2298.1	551.2	**9.3**
	25-29	86.8	866.2	2737.1	733.2	**9.7**	142.4	1169.6	2386.2	532.3	**8.8**
	30-34	112.7	945.0	2606.1	666.1	**9.5**	200.4	1315.4	1973.3	682.0	**8.7**
	35-39	125.1	787.9	1928.5	473.2	**9.1**	236.5	1112.8	1360.4	485.6	**8.1**
	40-44	138.2	718.3	1243.2	320.5	**8.7**	300.4	922.7	825.0	336.8	**7.6**
	45-49	167.8	598.3	1045.1	253.7	**9.0**	390.7	763.4	767.3	132.7	**6.9**
	50-54	208.6	507.9	896.4	219.4	**8.8**	470.1	599.8	607.7	105.8	**6.3**
	55-59	259.2	486.8	610.1	175.4	**7.9**	546.0	514.4	382.0	70.5	**5.1**
	60-64	240.6	406.3	331.7	144.0	**7.2**	575.1	403.4	215.1	58.6	**4.2**
	65+	663.2	604.8	297.9	160.3	**5.1**	1428.0	461.1	183.8	52.9	**2.4**
	15+	*2089.3*	*7074.7*	*16675.2*	*3868.1*	***8.9***	*4414.6*	*8753.7*	*13147.8*	*3008.3*	***7.5***
	25+	*2002.1*	*5921.4*	*11696.1*	*3145.8*	***8.7***	*4289.4*	*7262.6*	*8700.8*	*2457.1*	***7.1***
2020	15-19	20.6	411.2	2607.3	0.0	**9.1**	23.2	502.9	2374.7	0.0	**8.8**
	20-24	28.9	442.8	1848.6	549.3	**10.3**	38.4	562.8	1721.5	418.4	**9.6**
	25-29	57.5	701.0	2545.5	716.8	**10.0**	86.1	921.3	2318.4	518.9	**9.2**
	30-34	85.9	858.7	2718.8	727.9	**9.7**	141.5	1163.4	2165.6	740.8	**9.2**
	35-39	111.5	936.4	2587.2	662.2	**9.5**	199.0	1307.2	1963.7	679.4	**8.7**
	40-44	123.4	778.7	1910.8	469.9	**9.3**	234.2	1103.5	1351.9	483.3	**8.4**
	45-49	135.4	705.4	1226.2	317.2	**9.3**	296.2	911.5	817.6	334.7	**8.0**
	50-54	161.8	579.7	1020.4	249.3	**9.1**	382.4	749.5	757.3	131.5	**7.0**
	55-59	196.0	481.1	860.0	212.7	**8.8**	455.3	583.6	595.9	104.4	**6.4**
	60-64	235.3	447.1	571.6	167.2	**8.0**	519.8	493.2	371.0	69.2	**5.2**
	65+	609.5	774.4	526.7	258.7	**6.4**	1531.1	739.1	359.3	103.3	**3.3**
	15+	*1766.0*	*7116.5*	*18423.1*	*4331.1*	***9.2***	*3907.4*	*9037.9*	*14796.9*	*3583.8*	***8.0***
	25+	*1716.6*	*6262.4*	*13967.2*	*3781.8*	***9.1***	*3845.8*	*7972.2*	*10700.7*	*3165.4*	***7.7***
2025	15-19	15.2	418.6	3125.3	0.0	**9.2**	13.7	489.9	2896.9	0.0	**9.1**
	20-24	20.4	408.6	1970.9	619.6	**10.5**	23.1	501.0	1894.5	471.0	**10.0**
	25-29	28.6	438.7	1834.2	544.8	**10.3**	38.1	559.6	1735.3	394.1	**9.6**
	30-34	57.0	695.4	2529.4	712.0	**10.0**	85.6	916.5	2102.4	723.2	**9.6**
	35-39	85.1	851.8	2701.1	724.1	**9.7**	140.6	1156.6	2155.7	738.2	**9.2**
	40-44	110.2	926.9	2566.7	658.1	**9.6**	197.3	1297.4	1952.6	676.6	**8.9**
	45-49	121.2	766.0	1887.2	465.5	**9.9**	231.2	1091.1	1340.7	480.5	**8.9**
	50-54	130.9	685.1	1199.5	312.1	**9.4**	290.3	895.9	807.5	331.8	**8.1**
	55-59	152.6	550.5	981.4	242.2	**9.2**	371.2	730.5	743.6	129.9	**7.0**
	60-64	178.3	442.5	806.8	202.9	**8.9**	434.2	560.3	579.0	102.4	**6.4**
	65+	585.0	938.5	925.5	359.3	**7.4**	1581.7	1052.1	659.2	158.0	**4.3**
	15+	*1484.5*	*7122.6*	*20528.2*	*4840.6*	***9.5***	*3407.1*	*9250.8*	*16867.3*	*4205.7*	***8.4***
	25+	*1448.9*	*6295.4*	*15431.9*	*4221.1*	***9.5***	*3370.3*	*8260.0*	*12076.0*	*3734.7*	***8.2***
2030	15-19	9.3	381.0	3373.8	0.0	**9.3**	5.9	422.6	3168.6	0.0	**9.2**
	20-24	15.1	416.3	2330.8	777.3	**10.8**	13.6	488.2	2298.0	589.2	**10.3**
	25-29	20.2	405.1	1956.9	615.0	**10.5**	23.0	498.3	1910.3	444.4	**9.9**
	30-34	28.4	435.0	1821.5	540.9	**10.3**	37.9	556.4	1569.7	549.8	**10.0**
	35-39	56.5	690.2	2513.9	708.4	**10.0**	85.1	911.4	2093.1	720.7	**9.6**
	40-44	84.3	844.1	2681.8	720.1	**9.9**	139.5	1148.5	2144.3	735.3	**9.4**
	45-49	108.5	913.5	2538.4	652.7	**10.2**	194.9	1283.9	1937.7	672.9	**9.4**
	50-54	117.5	745.6	1848.8	458.5	**10.1**	226.9	1073.5	1324.8	476.5	**9.0**
	55-59	124.0	652.8	1156.1	303.7	**9.4**	282.1	874.0	793.2	327.7	**8.1**
	60-64	139.6	508.7	923.3	231.5	**9.2**	354.8	702.8	723.4	127.6	**7.0**
	65+	534.3	1053.3	1452.3	468.5	**8.3**	1543.6	1362.0	1113.5	236.2	**5.3**
	15+	*1237.6*	*7045.7*	*22597.6*	*5476.6*	***9.9***	*2907.4*	*9321.6*	*19076.6*	*4880.1*	***8.9***
	25+	*1213.2*	*6248.3*	*16893.0*	*4699.3*	***9.8***	*2887.8*	*8410.7*	*13610.0*	*4291.0*	***8.6***

3. Iran's fertility decline

Studies reveal that the changes in fertility in Iran during the late 1960s and early 1970s have been small. The total fertility rate (TFR) decreased from above 7.0 in 1966 (Amani 1970, 1996; Aghajanian and Mehryar 1999; Ladier-Fouladi 1997) to around 6.5 in 1976 (Mirzaie 2005). Due to socio-political changes as well as the revolutionary protests during the years preceding the 1979 Islamic Revolution, like many other government activities, the family planning program became inactive during the years 1977 to 1979. The TFR rose to 7.0 by 1980. However, Iran has experienced a phenomenal fall in fertility since the mid-1980s. The TFR declined from 7.0 in 1980 to around 5.6 in 1988 (Figure 4). The decline of fertility was slow until the new family planning program was officially inaugurated in 1989. The TFR fell sharply as of that time, dropping from around 5.6 in 1988 to around 2.8 in 1996, and to 2.2 in 2000 (Abbasi-Shavazi and McDonald 2006). Recent estimates of fertility indicate that the TFR declined to around 1.9 in 2006 (Abbasi-Shavazi and Nourollahi 2008).

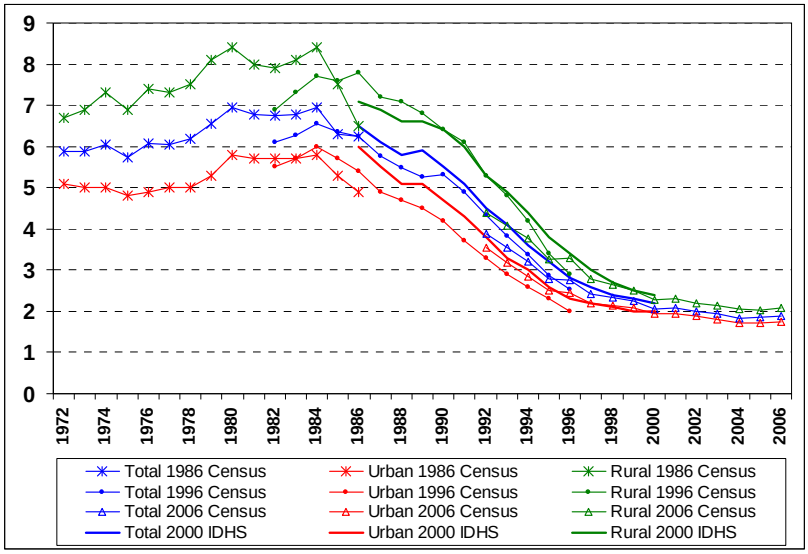

Figure 4. Own-children estimates of total fertility rates for Iran, 1972–2006. Sources: Abbasi-Shavazi and McDonald (2005, 2006); Abbasi-Shavazi and Nourollahi (2008).

The sharp fall of fertility in Iran since the mid-1980s deserves attention. That the decline occurred in an Islamic country is remarkable, particularly considering the socio-political context in Iran during and after the Islamic Revolution. Indeed, the decline of fertility (after the rise during the 1979 Islamic Revolution) started in the mid-1980s when there was no population or family planning policy. However, the decline accelerated with the reinstatement of the family planning program in 1989.

The similarity of the transition in both urban and rural areas is one the main features of the fertility transition in Iran. There was a considerable gap between the fertility in rural and urban areas, but the TFR in both rural and urban areas continued to decline by the mid-1990s, and the gap has narrowed substantially. In 1980, the TFR in rural areas was 8.4 while that of urban areas was 5.6. In other words, there was a gap of

2.8 children between rural and urban areas. In 2006, the TFR in rural and urban areas was 2.1 and 1.8, respectively (a difference of only 0.3 children).

Age-specific fertility rates, 1972-2006

Figure 5 shows age-specific fertility for the period, 1976-2006. In 1976, the highest age-specific fertility rate was recorded for the age group 20-24 (283 per 1,000 women) followed by age groups 25-29 (268 per 1,000 women) and 30-34 (231 per 1,000 women). From 1976 to 1980, increases in fertility were evident for all age groups. However, during the first half of the 1980s, although the TFR remained high and nearly constant, the age pattern shifted towards later childbearing and the peak of childbearing occurred in the age group 25-29. The decreases in fertility at younger ages were matched by increases at older ages. Thus, Iranian women had a relatively early childbearing pattern in the first year of the revolution, consistent with the pronatalist ideology adopted by the government. This behavior did not last long, however, and as age at first marriage increased, fertility shifted to a relatively later childbearing pattern.

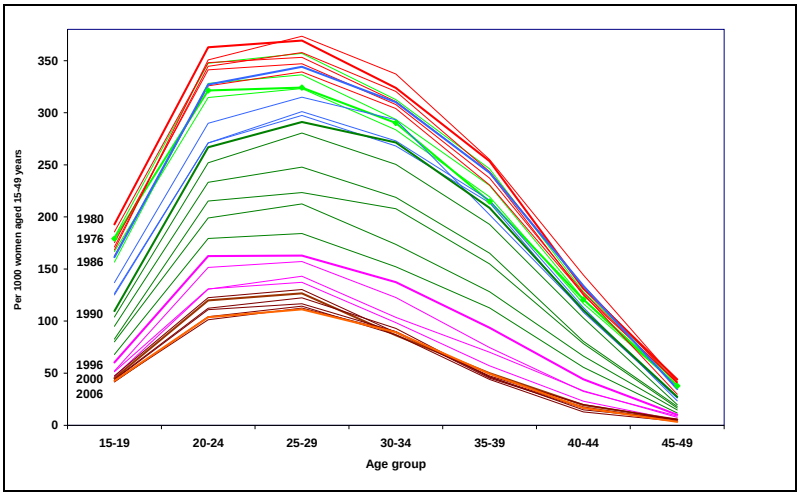

Figure 5. Own-children estimates of age specific fertility rates for Iran, 1976-2006. Sources: Abbasi-Shavazi and McDonald (2005, 2006); Abbasi-Shavazi and Nourollahi (2008).

The figure depicts a remarkable fall in fertility in all age groups during 1986-1996. The rate of decline was slower afterwards, as there was less scope for further decline during this period. There was also an indication of a further shift towards delayed childbearing starting in 2000. By 2006 the peak of childbearing is observed in age group 25-29 which confirms a time lag between the first and second birth as well as the end of childbearing at parity 2 or 3 during the 1980s and 1990s (Hosseini-Chavoshi et al. 2006).

Age-specific fertility rates for rural and urban areas for the period 1976-2000 (data not presented here) reveal that, in general, the trends in age patterns of fertility for both rural and urban areas during the period were similar to those at the national level

(Abbasi-Shavazi and McDonald 2005, 2006). The gaps between the TFRs in rural and urban areas had narrowed considerably by the end of the 1990s.

4. The change in education fertility differentials

Studies have so far focused on factors influencing fertility decline in recent years. Government policies, such as the extension of public education, particularly for girls, the establishment of the health network system, and the increase in access to electricity and safe water, transport and communication in remote areas of Iran, most likely had an indirect effect on fertility decline. Abbasi and McDonald (2006) have suggested that education has been an important factor in fertility decline in Iran. The advancement of a girl's education has affected the delay of marriage and childbearing. High aspirations and investments by families in their children's schooling are also likely to have affected couples' fertility decision making. However, no comprehensive study has been undertaken to examine the role of education on the Iranian fertility decline. This is the aim of this study. In this section, fertility differentials by education are discussed. First, the mean number of children ever born by the level of education in 1976 and 2000 are presented. Then we switch to the own-children estimates of fertility by level of education.

Table 4. Mean number of children ever born by level of education, 1976 and 2000. Source: Agha (1985).

Survey year	Age group	Illiterate	Primary	Secondary	Diploma or Higher	Total
IFS 1976	**15-24**	1.7	1.4	0.9	0.7	**1.6**
	25-34	4.6	3.6	2.2	1.3	**4.2**
	35-39	6.6	5.3	3.5	1.7	**6.3**
IDHS 2000	**15-24**	1.5	1.0	0.7	0.4	0.8
	25-34	3.7	2.6	2.2	1.4	2.5
	35-39	6.5	4.9	3.7	2.7	5.1

Data on fertility differentials by education in the 1970s are limited. The Iran Fertility Survey (IFS) is one of the main studies that provides information on fertility and childbearing in the 1970s (see Aghajanian et al. 1992). The IFS results (Table 4) indicate that there were educational differences in all age groups (Agha 1985). For example, of women aged 25-34, illiterate women had considerably higher children ever born (4.6) than women with other levels of education: primary (3.6), secondary (2.2), and diploma and higher (1.3). In the same age group, there was a significant gap (3.3 children) between illiterate women and those with diploma and higher. On average women aged 35-39 had around 6.3 children ever born at the time of the 1976 IFS. Educational differences remained unchanged by 2000. Illiterate women aged 25-34 had on average 3.7 children as compared to 1.4 for those with diploma and higher. The

results also show that children ever born for all levels of education at different age groups decreased from 1976 to 2000, except for women aged 35-39 at the latter educational levels (secondary, diploma and higher). This is probably due to the educational composition of the population in 2000, as the majority of rural women who had higher fertility in the 1970s attained higher levels of education by 2000. Although the level of education for the general population has increased, some women may have retained aspects of their cultural beliefs about high fertility rather than adopting the views of their new educational category. A similar result was found by Abbasi-Shavazi et al. (2008) with regard to the higher prevalence of consanguinity among the more educated women in four provinces of Iran.

Children ever born does not show the real level of fertility at the time of the survey as children are those who have been born around 15-20 years prior to the survey. Thus, we will use age-specific fertility rates and total fertility rates for the periods 1986 and 2000. The results are based on the own-children estimates of fertility using the Iran Demographic Health Survey (IDHS) (the figures will be updated with the results of the 2006 census later) (see Ministry of Health and Medical Education 2000).

It should be noted that based on the 'constancy of membership' assumption of the own-children method, one can only reverse survive women by those characteristics that are not changeable across time. For example, such characteristics as ethnicity, place of birth, language, and religion do not change across time, and thus, it is possible to reverse survive women by these characteristics and estimate fertility differentials. However, such characteristics as occupation, income, and education are subject to change across time, and thus it would be problematic to reverse survive women by these characteristics for 15 years previous to the census or survey. The reason is that women who were at the education category with diploma and higher at the time of the census may have been at the secondary level of education 5 to 10 years before the census. As a result, estimating fertility based on the educational structure of the population in 2000 for years preceding the survey is misleading and the results should be analyzed with caution. However, if the age structure and other characteristics of the population have not changed very much across time, it can be possible to estimate fertility based on these characteristics. Thus, for the purpose of this paper, we assume that the fertility differentials by the educational structure of the women have remained constant during the years preceding the IDHS.

Figure 6 shows the trend of total fertility rates during 1986 and 2000 by educational categories as well as the trend for Iran as a whole. The trend and pattern seem plausible for two reasons. The results indicate that there have been differences in fertility by level of education in the mid-1980s. For example, illiterate women in 1986 had around 7.3 children while women with primary level education had around 6.2 children. The TFR for women with secondary and high-school levels of education was around 5.1, while women with diploma and higher had on average 3.8 children. On average, illiterate women had 3.5 children more than those with diploma and higher levels of education.

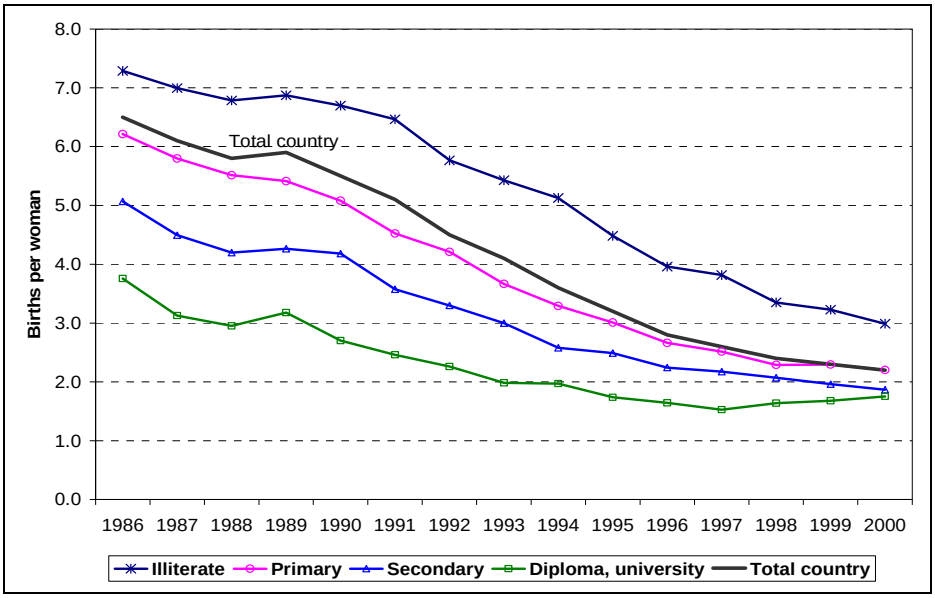

Figure 6. Own-children estimates of TFR by level of education during 1986-2000. The figures are estimated from the IDHS using the own-children method.

There is a downward trend for educational age-specific fertility rates during 1986 and 2006. The pace of decline during the first four years (1986-1989) was slow, but it accelerated afterwards due to the revival of the family planning program in 1989. The decline continued for illiterate women and other educational categories until 2000, but the level of TFR for women with the highest category of education declined to the lowest level in 1997, and there was a slight upward trend during 1997-2000. The decline may have been due to the tempo effects as women in this category have postponed marriage and childbearing to continue their education. By 2000 the gap between the levels of fertility for all categories of education narrowed significantly. There was only 1.2 children difference between the TFR for women with diploma and higher (1.8 children) and those who were illiterate (3.8 children). The level of TFR for women with secondary and high school (1.9) was relatively similar to that of women with diploma and higher (1.8). However, there was a significant gap (0.8) between the TFR for illiterate women and those with a primary level of education.

Figure 6 also shows the trend of fertility for the national level as a whole. It is interesting that the national level trend was higher than the trend for those with a secondary level of education during the mid-1980s. By the late 1990s, the trend had converged to the level of fertility with those having a secondary level of education.

The age pattern of fertility by level of education during the three five-year periods, 1986-1990, 1991-1995, and 1996-2000, has been illustrated in Figure 7. As discussed earlier, the level of fertility varied considerably by level of education during the first five-year period, but the gap was reduced substantially by the third period. The age pattern for women who were illiterate and for those with primary and second levels of education was indicative of a relatively early childbearing. The peak of childbearing for women of all educational categories except those with diploma and higher was

observed in age group 20-24, and as expected, women with diploma and higher had a delayed childbearing pattern.

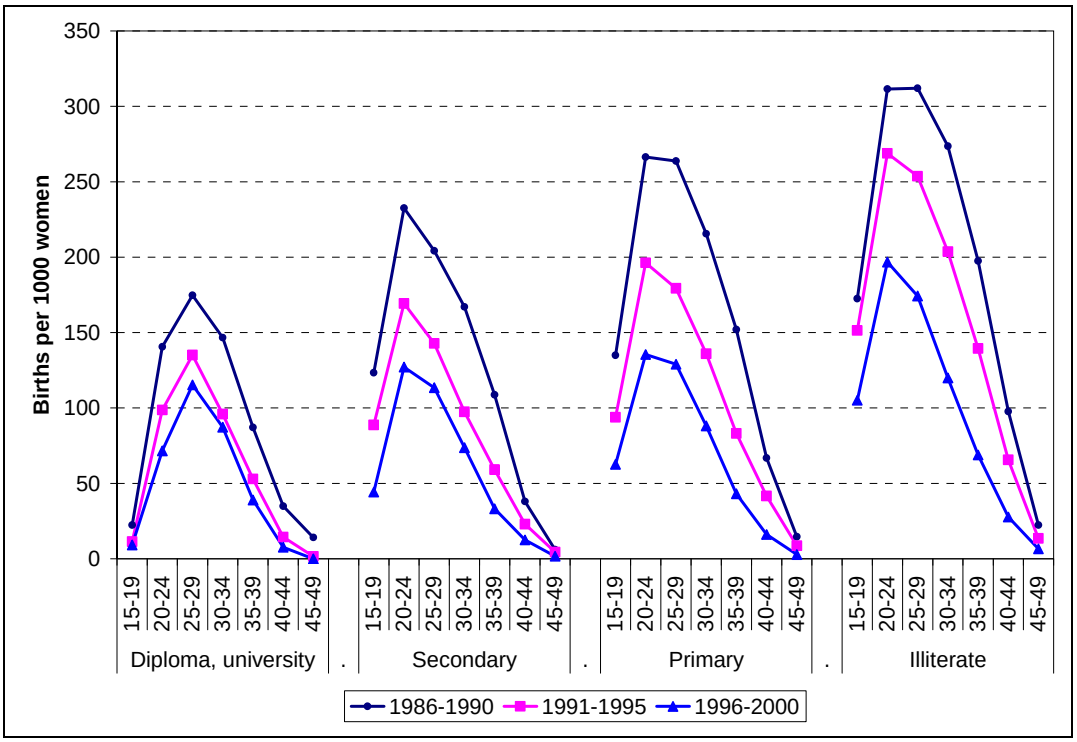

Figure 7. Own-children estimates of age-specific fertility rates by level of education during the periods 1986-1990, 1991-1995, and 1996-2000. The figures are estimated from the IDHS using the own-children method.

5. Decomposition: How much of the Iranian fertility decline since 1980 was due to the improved education of the female population?

The previous sections have described two major social changes in Iran independently, the stunningly rapid fertility decline and the equally amazing increase in female educational attainment over the last 2-3 decades. Both social changes are not independent, however. It can be assumed that the rapidly increasing educational status of Iranian women played an important part in the decline of the total fertility rate. There are reasons to assume that a fall in the birth rate makes it easier to expand the educational system and increase female school enrolment rates. For this specific mechanism, however, the causation is less direct and there are significant time lags. It may take more than two decades for lower birth rates to translate into better educational attainment of young adults. This relationship is also greatly affected by exogenous political efforts to push for higher school enrolment rates, as has actually happened in Iran since the 1980s.

For these reasons, our analysis will focus only on the more direct relationship between improving educational attainment of women in childbearing ages and their fertility behavior. In particular we want to estimate the relative strength of the two forces: 1) Fertility decline due to behavioral changes of women in the same educational group (e.g., decline of fertility among women with tertiary education); and 2) fertility decline due to the improving educational composition of the population (e.g., an increasing proportion of all women have tertiary education associated with lower fertility).

There are many different ways of carrying out such decomposition exercises. The easiest and most straightforward is to perform counterfactual calculations which assume that one factor (such as education- and age-specific fertility rates, ESASFR) stays constant over time and only the other factor (distribution by level of education) changes. A comparison between the actual trend and the counterfactual can then be the basis for quantifying the relative strength of both forces of change.

When one actually starts to apply such procedures, one finds that the task is less straightforward than it initially seems. The first problem is that any decomposition of this kind can only be applied to monotonous (preferably linear) trends. We have, however, seen in the previous section that the fertility trend in Iran between the 1970s and 2000 was not linear. The TFR reached a peak in the early 1980s and only then started to decline monotonously (but at decelerating speed) to 2000. As a consequence we decided to restrict the decomposition exercise to the period 1980-2005 during which fertility is assumed to decline more or less monotonously. Actually, the reconstructed period TFRs still seem to indicate a minor increase between 1980 and 1984, but we can assume that this is merely an irrelevant, short-term fluctuation caused by tempo distortions. The 1980 level better reflects the average fertility level around that time.

The second problem that arises is even more disturbing. Since the educational fertility differentials are much more pronounced at the beginning of the period than towards its end, the relative weight assigned to the changing educational structure (which is a function of the extent of the differentials) depends greatly on the direction into which the counterfactual is being calculated. One can either keep the sizable 1980 differentials constant to 2005 or one can keep the much smaller 2005 differentials constant in a backward projection to 1980.

Table 5 shows the results of both exercises. The first column gives the actual observed overall TFRs from 1980 to 2005. They show a decline from around 7.0 in 1980 to 1.90 in 2005. The second column gives the first decomposition exercise which applies the 1980 education-specific and age-specific fertility rates (ESASFFR) to the education and age structure of women as it changes over time. For 1980 this must by definition yield the same TFR as the empirical TFR indicates. By 1985 the TFR, resulting from applying the 1980 fertility rates to a changed education composition of the female population, yields a somewhat lower overall TFR of 6.57 because there are already more educated women who have lower fertility. This value of 6.57 is still higher than the empirical of 6.30 because in reality, fertility rates within educational groups also declined. Continuing this exercise to the year 2005, we get a TFR of 5.16 resulting from an application of the 1980 education-specific fertility rates to the education structure of women of 2005. This implies that a TFR decline of 1.80 (6.96 – 5.16) can be attributed exclusively to the improving educational composition of the population.

Since the TFR actually declined by 5.06 (from 6.96 to 1.90), the rest of the decline must be due to declines in education-specific fertility rates. Since 1.80 is 36 percent of 5.06, we can conclude that under this approach a bit more than one-third of the total fertility decline has been due to improvements in female education, and less than two-thirds due to fertility declines within groups of the same educational attainment.

Table 5. Total fertility rates and decomposition of fertility by education, Iran, 1980-2000.

Year	TFR	Constant ESASFR 1980, changing education distribution	Constant ESASFR 2000, changing education distribution
1980	**6.96**	**6.96**	2.28
1985	6.30	6.57	2.19
1990	5.32	6.16	2.10
1995	2.87	5.72	1.99
2000	2.17	5.44	1.93
2005	**1.90**	5.16	**1.90**

The third column gives a decomposition exercise that goes backwards in time. It starts by applying the 2005 age-and education-specific fertility rates to the education distribution of 2005, which yields the empirical TFR of 1.90 for 2005. Now we go back in time, keeping education-specific fertility constant at its 2005 level and only applying the educational structures of the earlier years. Back in 1980 this gives an overall TFR of 2.28 resulting from a combination of the 2005 education-specific fertility rates with the 1980 education structure. This is only an increase in TFR of 0.38 which is not surprising because the fertility differentials in 2005 are much smaller, as can be seen in Figure 6. A decline in absolute fertility differentials in times of overall fertility decline is a common feature for most countries. Relative differentials show a more varied picture. But under this perspective of applying the much reduced absolute differentials, only 8 percent of the overall fertility decline of 5.06 children per woman would be explained by the fact that in 1980, women were less educated.

Which of the two estimates of the contribution of education is the more appropriate one: 36 percent or 8 percent? There is no clear cut answer to this question. It depends on the perspective taken. Are both perspectives equally valid and intuitive? Probably not. The forward looking perspective is probably more in line with our usual thinking that follows the course of history. We could think of it as an experiment in which one gives women in 1980 in each of the educational groups instructions to strictly maintain their reproductive behavior and tells new women entering their educational categories to do the same. The fact that female education improves would result in the TFR declining by one-third until 2000. As artificial as this may sound, the backward

perspective is even worse because there is no experimental setting that one could think of that would produce the 8 percent contribution.

Hence, in conclusion, if pressed to choose, we would rather go with the one-third estimate. But we would stress at the same time that such decomposition exercises are a highly artificial business based on many simplifying assumptions that do not give full justice to real world social trends, where there is a complex and interwoven co-evolution of education and childbearing behavior.

6. Discussion

A decline in the TFR of more than 5.0 in roughly two decades is a world record in fertility decline. This is even more surprising to many observers when one considers that it happened in one of the most Islamic societies. It forces the analyst to reconsider many of the usual stereotypes about religious fertility differentials. While in many industrialized countries the fertility of Muslim minority populations is significantly higher than that of the women belonging to the (mostly Christian) majority populations, this may not be due to religion per se, but rather to specific social and economic characteristics of the populations compared. In Austria, for example, the Muslim fertility level is higher by a factor of two. But the Muslim women living in Austria are mostly recent immigrants or descendents of immigrants from rural Anatolia. Their educational attainment is far below that of the average Austrian woman. It would be interesting to see how the religious differentials would turn out, if controlled for at the level of education.

But the Islamic Republic of Iran not only experienced the world's most rapid fertility transition, it was associated with a stunning increase in education and in particular female education. Young women in Iran today are almost as well educated as young men with an average of 8.4 years of schooling. This challenges another powerful stereotype, namely that Muslim societies discriminate against women for religious reasons. At least in Iran this does not seem to be the case with respect to education. And since education has been shown to be the most powerful long-term driver of emancipation, income and economic development (Lutz et al. 2008) there is reason for optimism concerning the future of Iran.

It is evident that the remarkable speed of fertility decline and the equally remarkable increase in female education are closely linked social trends. This paper has tried to provide a quantitative decomposition of the role that education played in the fertility decline. If the educational fertility differentials of 1980 are used as the standard, more than one-third of the actual fertility decline since then can be attributed directly to changes in the composition of the reproductive age population by level of educational attainment. The rest has been due to forces that brought down fertility rates among women at a given level of educational attainment. But although not measured in terms of the four formal education categories considered here, these drivers are likely to be associated with education in the broader sense. First, even in terms of formal education, within each of the four categories, women improved their education over time (higher mean years of schooling per category) which is likely to be associated with lower fertility. Second and more important, there are many channels of informal education and learning that contribute to value changes, changes in desired family size, more

information and better access to family planning, and hence, directly or indirectly contribute to fertility decline. More research on these informal channels of education that presumably matter for fertility is clearly needed.

7. References

Abbasi-Shavazi, M.J. 2000. Effects of Marital Fertility and Nuptiality on Fertility Transition in the Islamic Republic of Iran. Working Papers in Demography, No. 84. Canberra: The Australian National University.

Abbasi-Shavazi, M.J. and P. McDonald. 2006. The fertility decline in the Islamic Republic of Iran, 1972-2000. *Asian Population Studies* 2(3): 217-237.

Abbasi-Shavazi, M.J. and P. McDonald. 2005. National and Provincial-level Fertility Trends in Iran: 1972-2000. Working Paper in Demography, No. 94. Canberra: The Australian National University.

Abbasi-Shavazi, M.J. and T. Nourollahi. 2008. Recent Fertility Trends in Iran: Application of the Own-children Method to the 2006 Census. Paper presented at the 4th Conference of the Population Association of Iran, Tehran, March 4-5, 2008.

Abbasi-Shavazi, M.J., P. McDonald, and M. Hosseini-Chavoshi. 2008. Modernization and the cultural practice of consanguineous marriage: Case study in four province of Iran. *Journal of Biosocial Science* [online publication]: 1-23.

Abbasi-Shavazi, M.J., P. McDonald, and M. Hosseini-Chavoshi. 2003. Changes in Family, Fertility Behavior and Attitudes in Iran. Working Paper in Demography No. 88. Canberra: Australian National University.

Abdollahyan, H. 2004. The generation gap in contemporary Iran. *Journal of Welt Trends* 44: 78-85.

Agha, H. 1985. Study of fertility in Iran and its relation to socio-economic indicators based on the IFS [in Persian]. Shiraz, Iran: Population Studies Center, University of Shiraz.

Aghajanian, A. and A. Mehryar. 1999. Fertility transition in the Islamic Republic of Iran: 1967-1996. *Asia-Pacific Population Journal* 14(1): 21-42.

Aghajanian, A., A.B. Gross, and S.M. Lewis. 1992. Evaluation of Iran Fertility Survey. WP-93-2. Seattle: University of Washington, Center for Studies in Demography and Ecology.

Amani, M. 1996. An attempt at the historical outlook of the trends of births and death rates and study of the stage of demographic transition in Iran [in Persian]. *Journal of Population* 13-14: 71-83.

Amani, M. 1970. Births and fertility in Iran, division of population research [in Persian]. Tehran, Iran: Institute for Social Studies and Research, University of Tehran.

Caldwell, J.C. 1989. Mass education as a determinant of mortality decline. Pages 101-109 in J.C. Caldwell and G. Santow (eds), *Selected Readings in the Cultural,*

Social and Behavioral Determinants of Health. Health Transition Series, No. 1. Canberra: Australian National University.

Caldwell, J. 1982. *Theory of Fertility Decline*. London: Academic Press.

Cleland, J. 1990. Maternal education and child survival: Further evidence and explanation. Pages 400-419 in J.C. Caldwell, S. Findley, P. Caldwell, G. Santow, W. Cosford, J. Braid, and D. Broers-Freeman (eds.), *What We Know About Health Transition: The Cultural, Social and Behavioral Determinants of Health.* Proceedings of an International Workshop, Canberra, May 1989. Health Transition Series, No. 2. Canberra: The Australian National University.

Cochrane, S.H. 1979. *Fertility and Education: What Do We Really Know?* Baltimore, MD: John Hopkins University Press.

Hoodfar, H. 1996. Bargaining with fundamentalism: Women and the politics of population control in Iran. *Reproductive Health Matters* 8: 30-40.

Hosseini-Chavoshi, M., P. McDonald, and M.J. Abbasi-Shavazi. 2006. The Iranian fertility decline, 1981-1999: An application of the synthetic parity progression ratio method. *Population* 61(5-6): 701-718.

K.C., S., A. Goujon, W. Lutz, W. Sanderson, V. Skirbekk, and B. Barakat. 2008. Population Projections by Age, Sex and Level of Educational Attainment for 120 Countries for 2005-2050. Interim Report. Laxenburg, Austria: International Institute for Applied Systems Analysis. Draft manuscript. Forthcoming.

Kian-Thiebaut, A. 2002. Women and the making of civil society in post-Islamist Iran. Pages 56-73 in Eric Hooglund (ed.), *Twenty Years of Islamic Revolution: Political and Social Transition in Iran since 1979*. Syracuse, NY: Syracuse University Press.

Ladier-Fouladi, M. 1997. The fertility transition in Iran. *Population: An English Selection* 9: 191-214.

Lucas, D., and P. Meyer. 1994. The background to fertility. Pages 56-68 in D. Lucas and P. Meyer (eds.), *Beginning Population Studies.* 2nd edition. Canberra: The Australian National University.

Lutz, W., J. Crespo Cuaresma, and W. Sanderson. 2008. The demography of educational attainment and economic growth. *Science* 319: 1047-1048.

Lutz, W., A. Goujon, S. K.C., and W. Sanderson. 2007. Reconstruction of populations by age, sex and level of educational attainment for 120 countries for 1970-2000. Pages 193-235 in *Vienna Yearbook of Population Research 2007*. Vienna, Austria: Verlag der Österreichischen Akademie der Wissenschaften.

Ministry of Health and Medical Education. 2000. *Demographic and Health Survey*. Tehran: Ministry of Health and Medical Education.

Mir-Hosseini, Z. 2002. 'Religious modernists and the "women question'. Pages 74-95 in Eric Hooglund (ed.), *Twenty Years of Islamic Revolution: Political and Social Transition in Iran since 1979*. Syracuse, NY: Syracuse University Press.

Mirzaie, M. 2005. Swings in fertility limitations in Iran. *Critique: Critical Middle Eastern Studies* 14(1): 25-33.

Shadi-Talab, J. 2005. Iranian women: Rising expectations. *Critique: Critical Middle Eastern Studies* 14(1): 35-55.

United Nations. 2005. *World Population Prospects: The 2004 Revision*. New York: United Nations, Department of Economic and Social Affairs, Population Division.