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Working Paper 0109

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Abstract

Although it is widely recognized that demographic transition is not an uninterrupted process, fertility swings have been met with curiosity among demographers and population economists. Iran's experience of population growth after the Revolution points to a double paradox of a steep and unprecedented surge in population growth in the 1980s followed by a swift restoration of fertility decline in the 1990s. Interest in the population boom and bust of this period is highlighted by extensive socio-economic and institutional changes combined with radical and far-reaching sways in Iran's post-revolutionary population policy. This paper applies a standardization analysis to decompose and quantify the proximate components of change in the crude birth rate. The aim is to ascertain to what extent 'structural/demographic' or 'behavioral' factors can explain the dynamics of fertility and population change in Iran over the recent boom and bust cycles. Our findings point to the (hitherto neglected) role of population momentum in initiating the Islamic baby boom as well as a more limited role for population policy in explaining the *genesis* (rather than the *momentum*) of both boom and bust periods.

1. Introduction

Evidence on population growth in Iran after the Revolution points to a double paradox. The two decades since 1979 have witnessed first a steep and unprecedented surge in population growth lasting into the 1980s, followed by an even more vigorous and drastic fall in fertility throughout the 1990s.

In the first period, Iran's demographic transition stalled, and to some extent even reversed its course (Aghjanian, 1991).[1] During this period, the population behavior steered towards the experience of smaller Arab states with fast growing populations and high fertility levels incommensurate with their income and economic development levels, the so-called Middle Eastern 'population puzzle' (see Omran and Roudi, 1993). In sharp contrast, however, this trend has been reversed more recently establishing Iran at the forefront of demographic transition in the region in the 1990s.

Although it is generally recognized that demographic transition is not an uninterrupted process (Courbage, 1999: 2-3), population swings have drawn curiosity among demographers and population economists most notably the post-war baby boom in the West (see section 3 below on this and also some examples from the Middle East). Interest in the Iranian case has been heightened further by two considerations. First, the rapid pace of both baby boom and bust phases, which has been significant by all accounts with the bust possibly even being more drastic than the boom. Second, over the past two decades, Iran has undergone extensive socio-economic and institutional changes encompassing revolutionary turmoil, internal strife and external war. These changes have somewhat enriched and somewhat complicated the task of finding satisfactory explanations for Iran's population swings in these periods.

Two broad perspectives have emerged in this respect: those stressing the role of population policy in general and family planning in particular (see Aghajanian and Mehryar, 1999a), and those seeking primacy in socio-economic factors and developments (see Salehi-Isfahani and Tandon, 1999, as well as Sadeghi, 2000).

A marked feature of this period is sharp swings in the Islamic government's population policy, which has almost mirrored the population growth cycles. The Islamic 'baby boom' of the 1980s was characterized with strong pro-natalist policies. These included shutting down family planning clinics, promoting early marriage and discouraging birth control. These were reinforced by strong undercurrents of 'Islamisation' that operated at the regulatory and socio-economic levels seeking to redefine the role of women in the economy and to encourage their retreat into the family and domestic arenas.[2]

A swift and decisive reversal of these policies was, however, under way by the late 1980s as concerns over population growth began to spread among policy makers. An active population control program was introduced after 1988 marking a significant U-turn in official thinking and policy. An essential pillar of the new approach was the setting up of a Primary Health Network (PHC) by the Ministry of Health and Medical Education (MOHME). The Health Houses set up under this initiative have played a lead role in distributing and promoting contraceptives particularly in rural areas (Shadpour, 1994). Moreover, official benefits for household members have been cut back to three children only since the early 1990s (UNFPA, 1995: 14 and 20-23; see Aghajanian and Mehryar, 1999b for more details of the family planning program).

Given the near perfect match between these policy changes and fertility cycles, it is almost tempting to correlate radical changes in Iran's population growth with the Islamic government's population policy.[3] If correct, Iran's experience would appear as one of the most successful cases of social engineering in population policy in recent times. The implications will be of special interest for supply-side mechanisms (the PHC network) in achieving fertility reduction. In turn, this has major implications about the role of population policy in achieving fertility change in developing countries.

In this paper, we examine critically the developments in fertility and population spheres in the 1980s and 1990s focusing on the dynamics and possible causes of the rise and fall of fertility in Iran. In what follows, we use a methodology based on decomposition analysis of the determinants of the crude birth rate (CBR) – the so-called *standardization analysis* – to ascertain to what extent changes in four proximate components can account for changes in CBR. These are: age distribution of women in reproductive ages, the share of women in the total population (gender structure), age distribution of married women, and finally, age-specific *marital* fertility rates. This framework allows us to distinguish between the so-called 'structural/demographic' components (age and gender composition) and 'behavioral' factors (marriage marital status and marital fertility). The latter are arguably of a

[1] It is generally believed that Iran had embarked on her 'demographic transition' process (a combined process of declining death and birth rates) in the 1970s (i.e. before the Revolution; see Aghajanian, 1991).

[2] There is a copious literature dealing with changes in the position of women in Iran after the Revolution; see, *inter alia*, Moghissi (1995) for a discussion of employment, social and education policies affecting women in these years.

[3] Aghajanian and Mehryar come close to suggesting this when observing: 'Recent fertility trends in the Islamic Republic of Iran demonstrate the value of family planning programmes' (1999a: 21).

socio-economic nature and hence prone to policy inducement. This distinction hopefully enables us to shed light on the rich and complex array of factors that have influenced fertility in Iran.

The paper is organized as follows. Section 2 reviews the evidence on Iran's population dynamics since the late 1970s focusing on the dimensions of the boom and bust including a short comparison with the recent experience of other MENA countries. Section 3 reviews the main theories and approaches to the study of population swing (as distinct from demographic transition) and puts Iran's experience of boom and bust in a broader, international, perspective. The results of the standardization analysis are then reported and discussed in Section 4, where an attempt is made to break down changes in fertility over the period 1976-96 into its proximate elements. Section 5 re-examines the evidence on boom and bust to tease out the possible role of policy change. Finally, Section 6 summarizes the findings and offers some conclusions.

2. Population Boom and Bust: The Evidence

A clear indication of Iran's population boom and bust is given by an examination of the population growth rates before and after the Revolution. Figure 1 shows how in the last three decades – over the span of three intercensal periods 1966-76, 1976-86 and 1986-96 – the population growth rate first rose sharply and then fell back (giving a 'hump' shape). It can be seen that average annual population growth climbed to nearly 4 percent in the period 1976-86 followed by an even more striking fall in the 1990s (to 1.96 percent for 1986-1996). In the latter period, the decline has been particularly concentrated in more recent years (annualized growth rate for the period 1991-96 was 1.47 percent only).[4]

Abrupt changes of this nature observed over a relatively short period of time have inevitably raised some doubts about the accuracy and reliability of the data involved (see Hakimian 2000). Nevertheless, there is a consensus that significant changes in the fertility behavior of Iranian women underlay both periods' unusual and untypical demographic changes in the period under consideration. This is seen in Table 1, which summarizes Iran's main demographic indicators before and after the Revolution. In almost every respect, the 1980s appear to stand out for the rapid rise in population dynamics, and the 1990s for the noticeable reversal of this trend.

It can be seen that Iran's population expanded by 50 percent in the ten years to 1986, when it reached almost 50 million people. In incremental terms, this meant a staggering (net) total addition of about 16 million youngsters boosting Iran's population size, which stood at just under 34 million three years before the Revolution (in 1976). Other indicators too give an idea of the extent of the setback to demographic transition experienced in the 1980s: measured by child-woman ratio (CWR), fertility rose 17 percent (an average of 1.6 percent per annum) in this intercensal period, reaching almost 860 per thousand women of reproductive age. Similarly, average net annual incremental growth rose two-fold (reaching about 1.6 million per annum).

As mentioned already, the scale and speed of the downswing that followed seems to have been even more unusual. Table 1 shows that a significant slowdown was under way by the early 1990s and accelerated thereafter. Annual population growth rate, for instance, fell to an all time low of 1.5 percent over the 1991-96 period; net annual population increments fell back to below one million (from 1.6 million); and CWR contracted on average by about 9 percent per annum during 1991-96 (by 4.9 percent during 1986-91). Thus only a few years after population dynamics had escalated in Iran, the trend was sharply reversed and a substantial slowdown was well-established by the mid-1990s.

Table 2 puts Iran's demographic experience in a comparative regional context. It shows recent changes in the population growth tempo and underlying fertility indicators (crude birth rate, CBR, and total fertility rate, TFR) for Iran and other MENA countries in the 1980s and 1990s. This confirms two trends: first, that the much-delayed process of demographic transition in the MENA countries appears to have got under way across more or less the whole region by the 1990s, and second, Iran's experience of the 1990s appears to be leading this process.

After several decades of rapid population growth, the past decade and a half have seen a deceleration of the growth momentum in almost all MENA countries. This is true of even those countries (mainly the GCC States, Syria, Jordan and Libya) that experienced some of the highest growth rates in the world in the 1980s.[5] Only Israel and the UAE were exceptions to this rule with accelerating population growth in the

[4] These data are based on the National Censuses of Population and Housing conducted by the Statistical Centre of Iran (SCI). For a discussion of other sources of population data in Iran see, UNFPA (1995) and Hakimian (2000: 178-79). The 1980s' growth rate (3.9 percent) includes a sharp rise in Iran's refugee population from Afghanistan. Allowing for these, the growth rate is nearer to 3.5 percent (see Aghajanian, 1991). However, this ignores the fact that there was also significant international out-migration at this time. The latter is not, however, reliably quantified as most international emigration in this period was of a political nature consisting of political refugees and asylum seekers.

[5] According to the World Bank data, Iran, Bahrain, Jordan, Kuwait, Libya, Qatar, Saudi Arabia and UAE were amongst the seventeen developing countries with the highest population growth rates in the 1980s.

1990s. However, judged by CBR and TFR trends, it is clear that all countries in the region were experiencing a fall in their fertility indicators by the late 1990s.

Iran has been at the forefront of the slowdown process in the MENA countries (by 1998, only Qatar had experienced a sharper drop in her population growth rate). Again, judged by recent trends in birth and fertility rates, Iran's experience stands out as the sharpest and most drastic in the region: CBR and TFR contracted by an average of 4.8 percent and 6.5 percent per annum in the past decade (see Table 2).

The evidence examined in this section makes it clear that Iran's demographic development followed two contradictory phases in the 1980s and 1990s. In the initial phase, Iran's population behavior verged towards the rapidly expanding, and pro-natalist, experience of much of the Arab world. Subsequently, however, Iran regained her (pre-revolutionary) course of demographic transition and her experience was closer to countries such as Egypt and Turkey – with comparable population sizes and a more established track record of demographic transition. The road 'back' to transition, however, was marked by a significant, and largely unpredicted, population swing.

The next section puts Iran's experience of population boom and bust in a broader demographic and historical perspective.

3. Population Boom and Bust in Wider Perspective

Much of the post-war literature on population in developing countries has been influenced by discussions of the prospects for, or impediments to, demographic transition. In this context, considerations of short-term population swings or fluctuations in population growth have been generally muted by a broader interest in long-term downward secular trend in fertility.

One notable exception to this has been the work of Dyson and Murphy (1985), whose observations are drawn from a close study of historical demography. They have argued that a pattern of 'pre-decline' rise in fertility characterizes the experience of many societies going through long-term demographic transition. They draw from the fertility history of Europe over the last century and a half, as well as their own detailed compilation of birth rate data for several developing countries in more recent times, to suggest that in many parts of the world the evolution of birth rate follows a 'hump-shape.' This implies that in many cases, a rise in fertility has preceded an eventual fall and the onset of demographic transition. In their study, this pattern is prominent in nineteenth century Europe and contemporary Latin America and to a more varied extent in Asia.

Although Dyson and Murphy do not offer a theoretical explanation of the mechanism(s) for such pre-decline increases in fertility, Lee (1980) has ascribed similar 'ski jump' effects during demographic transition to a possible differential behavior between period fertility rate and reproductive goals[6]. For Dyson and Murphy, however, a surge in marriages (especially among the young) is a prominent feature in these historically observed periods of fertility increases (1985: 427).

Perhaps the best-known case of baby boom and bust in modern times is that of the western countries' after the Second World War. This post-war phenomenon is indeed associated with the rise of the so-called family economics as a new strand within economics in the post-war era and was driven by a motivation to explain a significant and seeming aberration from the well-established path of 'demographic transition' in industrial economies in general and in the US, in particular (see Kirk, 1996, for a useful review of developments in this period). Since the baby boom followed (occurred after) the end of the war and coincided with post-war growth and prosperity, much of the attention focused on the influence of the economic growth cycle, and to a lesser extent, on the effect of war itself on population growth (see Willis, 1987; Olsen, 1994).

Winter (1992: 291-309), for instance, has attributed changes in the population tempo in this period to the historical effects of war on women's social and economic roles. Through mass mobilization of men, he alleges, war greatly expands the role of women. However, in the post-war period demobilization brings them back to their family roles and responsibilities. According to him, it is this latter phenomenon (demobilization) that explains the post-war baby boom.[7]

Most prominent explanations of baby boom and bust have, however, focused on the underlying economic causes of fertility swings. In his seminal work, Easterlin (1969), sought to explain the boom and bust cycle in terms of shifts in preferences for children caused by changes in intergenerational relative incomes across different age cohorts. Accordingly, the rise in post-war fertility reflected the fact that the standard of living of the young exceeded those of their parents in the inter-war period and during the Great Depression years. Since the standard of living of the former (the

[6] Lee's explanation is based on a distinction between period fertility rate (F_t) and reproductive goals as defined by desired completed family size (D). During the transition from high to low values of D, he argues, F_t will fall more rapidly than D until D stops falling, then F_t will rise to the new stable level of D leading to a 'ski jump effect as the transition is completed.' (Lee, 1980: 214).

[7] According to Winter, however, since war also increases women's awareness of different choices and roles, in the long term, fertility is likely to resume its pre-war, declining, trend.

young) are supposedly formed when they grow up, the intergenerational improvement brought about by post-war prosperity was translated directly into a desire for more offspring and hence the observed swing in American fertility in the period 1946-57 (see Easterlin and Condran, 1976, for an application of his theory to other western countries).[8]

While Easterlin's pro-cyclical theory of population swings had relatively more success in explaining the post-war baby boom in the US, its application elsewhere did not prove uncontroversial. Both in the context of earlier periods of the US fertility history and other western countries' experiences of boom and bust, it spawned a battery of critical literature. Querying the postulated relationship between economic and fertility cycles, for instance, Sweezy has cast doubt on the validity of the Easterlin model in the US in the pre-war era and especially during the fertility slump of the 1920s (1971: 159).[9] In a similar vein, Ermisch (1979) has criticized the relevance of Easterlin's hypothesis to Great Britain's fertility surge during the 1955-1964 period (see Lesthaeghe *et al* for a similarly critical view in the context of some other European countries, 1988: 31-34).

Given that a central tenet of the Easterlin hypothesis is that fertility is an endogenous variable within a broadly equilibrating *economic* system (rising at times of prosperity and falling during harsher economic times), it is not surprising that his proposition has been less than warmly received by other professions concerned with population issues. For instance, sociologists have scorned the idea that material conditions alone can explain the demographic cycle of baby boom and bust. Instead, 'historical specificity and socialization' processes are required to reinforce the logic of economic rationality and to avoid 'reductionism to the simple socio-biological core of competition for material resources' (Lesthaeghe *et al*, 1988: 39). In fact, it was in this context of the search for relevant 'ideational' factors that Simons (1980) produced the most striking rival explanation for the boom and bust: the participation figures for Easter communion 'predict' the English baby boom better than Easterlin's intergenerational standard of living (Lesthaeghe *et al*, 1988: 36; see also Ermisch 1979).

Demographers too have been critical of the endogeneity thesis of population growth as expounded by economists from Malthus to Easterlin. Influenced by the tradition that demographic conditions at a particular moment in time affect population growth not only during the same period, but also 'in later years,' they have tended to view population dynamics from a 'generational' or structural point of view. This has led Lee, for instance, to distinguish between two types of population cycles: 'control' cycles on one hand and 'generational' or 'echo' cycles on the other. The former, emphasized by economists, reflect the 'lagged operation of an endogenous equilibrating mechanism.' The latter, by contrast, are principally demographic phenomena and have to do with the intrinsic 'dynamics of population renewal as an age-structured process' (Lee, 1974: 582). While questioning the empirical evidence in support of control cycles, Lee calls for a synthesis of the two approaches to provide a fuller explanation for population swings in industrial societies (1974: 583-84).

The 'income models' of population swing have been influential in explanations of continued high fertility in some of the MENA countries in the 1970s and 1980s. Fargues has suggested a positive association between the birth rate and households' standard of living in Egypt (1997: 124), while Courbage specifies oil revenues as the key mechanism for consolidating social preferences for large families in the Middle East (1999: 7)[10].

Iran's experience of baby boom and bust, however, stands out from the more familiar patterns of population swings discussed above in a number of interesting ways. First, it has been characterized as a largely *counter*-cyclical fertility surge. The 'Islamic' baby boom in fact occurred mostly during the 1980s when the economy experienced a severe contraction brought about by the combined effects of post-revolutionary upheaval and war with Iraq (see Hakimian and Karshenas 2000, and Behdad 2000 for a discussion of the economy in this period). Similarly, the baby bust of the late 1980s and early 1990s overlapped mostly with the period of reconstruction and growth that followed the end of the war. In neither phase, is a positive correlation between population and income growth cycles evident.

Iran's experience is unique in still another respect. The western experience of boom and bust was a post-war phenomenon. In Egypt, too, a surge in fertility during 1973-

[8] In his words: 'The basic idea is that if young men – the potential breadwinners of households – find it easy to make enough money to establish homes in the style desired by them and their actual or prospective brides then marriage and childbearing will be encouraged. On the other hand, if it is hard to earn enough to support the desired style of life, then the resulting economic stress will lead to a deferment of marriage and, for those already married, to the use of contraceptive techniques to avoid childbearing, and perhaps also to the entry of wives into the labour market.' (Easterlin, 1973: 181)

[9] Even regarding the baby boom period of 1930-60, he considers social mobility factors (such as education and occupations) were more important in explaining fertility changes than intergenerational income improvements.

[10] Similarly, he attributes the Moroccan baby boom and bust of the early to mid-1970s to the pervasive effect of the boom and bust in international phosphate prices in that period (Courbage, 1999: 8-9).

79 (the so-called Sadat's middle years) appears to have taken place well *after* the October war with Israel was over. As we saw above, this has led some economists to attribute population swings of this nature to the effects of war.[11] Yet, Iran's recent experience of baby boom coincided largely with the war years with Iraq (1980-88) rather than following it and is distinct from the more familiar pattern discussed above.

The discussion here has suggested that Iran's experience of baby boom has been differentiated from other known international experiences by virtue of the fact that it was largely counter-cyclical and occurred during (not after) war years. We now turn to an examination of the pertinent components of birth rate in order to shed light on the determinants and dynamics of the baby boom and bust cycles in Iran.

4. Accounting for Population Change

As the discussion in the last section has shown, accounting for the multiple and composite forces that lead to population booms and busts is a challenge for any careful study of population change. This is because population swings are brought about typically by a rich and composite array of factors operating at different levels: some are direct, some indirect; some are current and some reflect population conditions in the past. Moreover, some of these factors are socio-economic, and hence prone to policy changes, while others are more of a structural or demographic nature.

Horiuchi (1995) has devised a quantitative framework for 'retrospective decomposition' of population growth, which draws from the cohort approach (as distinct from period approach) in demographic method. He focuses on the past history of a population (rather than using current vital statistics) to account for its changes over time. Specifically, he decomposes total population growth rate in terms of the weighted sum of past changes in the following five factors: population size, age distribution, fertility, mortality, and migration. He applies this method to Sweden as the country with 'its long history of detailed and accurate demographic data,' to reconstruct the country's demographic history (1995: 162). His findings point to changes in fertility and migration as the largest variations behind population changes in Sweden over the past century and a half (1995: 153).

Although this approach is useful in breaking down population change over time into its constituent elements, in practice its data requirements limit the extent to which it can be applied in the context of developing countries. In the case of Iran, in particular, data on international migration are generally unavailable and mortality data are considered unreliable (see Hakimian, 2000).

In this section, therefore, we utilize a modified version of the so-called 'Standardization Approach' to account for changes in fertility. This approach recognizes the composite nature of factors that influence fertility and is applied when the general fertility rate (GFR) or the crude birth rate (CBR) is used as a measure of fertility over time[12].

In this context, the approach purports to offer a framework for standardizing or 'decomposing' the influence of the following four components:

1. Proportion of women of reproductive ages in the total population
2. Age structure of women of reproductive ages
3. Proportion of married women of reproductive ages; and
4. Marital age-specific fertility rates (see UN, 1989, for a full description of this methodology).

The approach has been most commonly used in studies concerned with evaluating the impact of family planning programs in LDCs since it allows researchers to decompose birth rate into its components and to isolate the influence of marital fertility rate from other factors (see Nortman, 1993 for a comparison of such methods).[13] As we shall see, however, the standardization technique can also be useful at a broader level of analysis. In particular, we regroup these four components into two broader categories: structural and behavioral factors. The age and gender compositions of the population (items 1 and 2 above) fall into the demographic or structural category, while marriage status and fertility patterns (factors 3 and 4 above) are of a behavioral nature by virtue of the fact that they are prone to socio-economic changes and policy influences.

More specifically, in this framework, CBR is expressed as follows:

$$CBR = \left(\sum_i A_i . M_{pi} . F_{mi}\right)\left(\frac{W}{P}\right) \qquad (1)$$

[11] Fargues, however, discounts the impact of war on fertility surge in Egypt as limited to demobilisation and family reunions after the war, dismissing it as transitory and of limited magnitude (1997: 122-23).

[12] Despite the well-known shortcomings of the crude birth data and vital statistics in developing countries, their relative availability make them useful for analysis of fertility trends (see Dyson and Murphy, 1985: 403-5).

[13] However, this is only a preliminary step, as it would require further corroborative evidence (such as use of contraceptives) to be able to attribute changes in marital fertility (if any) to programme impact (Bogue *et al*, 1993: 25-271).

where:

i: five-year age groups within the reproductive ages band (group) (15-49)

A_i: age distribution of women of reproductive ages (the proportion of women in each age group i among all women of reproductive ages)

M_{pi}: proportion of married women among all women in age group i

F_{mi}: age-specific marital fertility rate in age group i; and

$\left(\frac{W}{P}\right)$: proportion of women of reproductive ages in the total population[14].

[14] This is based on the following specifications:

CBR = B/P or: (1)

CBR = B/W . W/F . F/P (1)'

Where:

B = number of births

P = total population

W = number of women of reproductive ages

F = number of females in the total population

Hence: CBR = B/W . W/P (2)

But: B/W = GFR (general fertility rate) (3)

Thus: CBR = GFR . W/P (4)

Moreover, assuming that all births are legitimate and occur only to women in the specified age groups i, total births can be expressed as:

$$B = \sum_i W_i . M_{pi} . F_{mi} \quad (5)$$

and:

$$CBR = \frac{\sum_i W_i . M_{pi} . F_{mi}}{P} \quad (6)$$

GFR can be expressed as follows:

$$GFR = \frac{\sum_i W_i . M_{pi} . F_{mi}}{W} \quad (7)$$

and likewise:

$$CBR = \frac{\sum_i W_i . M_{pi} . F_{mi}}{W} . \frac{W}{P} = \left(\sum_i A_i . M_{pi} . F_{mi}\right) \frac{W}{P} \quad (8)$$

where: $A_i = W_i/W$ (or the age structure component).

As we shall see below, the latter expression (equation 8) is used for the decomposition analysis. For a full discussion, see Bogue *et al* (1993: 25-273–25-274).

In what follows in this section, first we look at the behavior of each of these four 'proximate' factors to gain an insight into their evolution over time during the two decades covering the boom and bust cycles in Iran (1976-1996). We then offer the results of the standardization exercise carried out in order to ascertain the relative importance of each of these during the period under study. A discussion of the findings follows.

4.1 The Proximate Determinants of the Birth Rate

Tables 3-5 provide summary data on the age distribution of women, distribution of women's marital status and finally their age-specific marital fertility rates. As mentioned above, the discussion relates to women in the reproductive ages (15-49) and is disaggregated at the 5-year age cohort levels. The data are based on the full census reports of 1976, 1986 and 1996 and the survey-census report of 1991, which was carried out for the first time on a five-yearly basis reflecting concerns about the rapid population growth of the 1980s. Although we will refer to the intercensal periods of 1976-86 and 1986-96 as the 'boom' and the 'bust' years, respectively, this is likely to be a simplification as the data points do not conveniently fit into the beginning and end of either cycle. Moreover, the inclusion of the 1991 data allows us to disaggregate the bust period (1986-96) into two shorter periods (1986-91 and 1991-1996), hopefully, allowing us to gain more insight into the bust period.

Table 3 shows the age distribution of Iranian women of reproductive ages (A_i's in the notation used above). Two issues emerge from this table. First, there was a big rise in the absolute number of women in reproductive ages in 1986 (up by over 42 percent; although their relative share in both total population and total female population declined somewhat). Second, within this category (women of reproductive ages), there was a redistribution in favor of those in their prime reproductive age cohorts (towards those in the 25-29 and 30-34 groups and away from those above 40 years). The combined effect of both these changes would be, c*eteris paribus*, to boost the general fertility rate. This rise is especially true of the boom years (see the underlined figures for 1986 in Table 3).

This evidence appears to suggest that at least part of the post-Revolutionary boom was due to demographic/structural factors, which reflected the population momentum from earlier on. Moreover, even though these ratios became moderated after 1986, they still remain higher than before the Revolution (1976). This too suggests that the subsequent bust has been *in spite* of historically high shares of women in the age groups 25-34.

The same table also shows the proportion of women of reproductive ages in the total population ($\left(\frac{W}{P}\right)$ in the above notation) decreased in the boom period and has risen sharply during the bust phase (it fell to 21.3 percent in 1986 but has since risen sharply reaching 24.4 percent in 1996). This movement has a downward effect on birth rate (as opposed to GFR since the denominator shows a bigger population). This in turn seems to suggest that in fact the baby bust has been even more significant than apparent given the rise in $\left(\frac{W}{P}\right)$. This factor can of course act as a possible ignition to future baby booms.

Table 4 provides information on the age distribution of married women (M_{pi}). Two trends can be seen clearly here. First, there has been a general and sustained decline in the proportion of married women among the total female population in the country. Interestingly, this is true even of the boom period, when the decline was representative of all age cohorts (the general average fell to 73 percent in 1986 from 75.1 percent a decade earlier). This peculiar phenomenon appears to fly in the face of much ideological emphasis and official incentives at the time, which favored marriages in general, and early marriages, in particular. On the contrary, the young appear quite immune to official encouragement provided in favor of family in this period (the share was stable for the 15-19 age cohort, and declined substantially for those in the 20-24 cohort).

Second, and in the bust period (after 1986), this trend reflects a clear movement towards later marriages as seen in the rising shares of married women among higher age cohorts. This is true of both 1991 and 1996 data, which show a decline in the share of married women among those below 29 years, a somewhat stable pattern among those in the middle cohorts (30-39) and a rise among those above 40.

The evidence here in turn appears to suggest three things. First, unlike in the case of 'pre-decline rises in fertility' (see discussion of Dyson and Murphy in section 3 above), there is no evidence of a 'marriage surge' invigorating fertility increases in Iran in the boom period. Second, and related to this, in fact the boom would have been even more significant had there not occurred a downward and moderating movement in the relative importance of marriage preferences and/or opportunities among women during the late 1970s and early 1980s. As we saw this fact goes against expectations, given the type of conservative social changes that affected women in Iran at the time. Third and last, the young have been at the forefront of the reduction in fertility during the bust period as suggested by a clear shift toward delayed marriages among young women, in particular.

This brings us to a consideration of marital fertility rate as the residual component in determination of fertility (GFR or CBR). Here, Table 5 gives age-specific marital fertility rates by age cohorts and also indicates the extent of changes that occurred over both periods under consideration. A number of interesting observations arise from an examination of these data, too.

First, as suggested earlier, the bust appears to have been even more robust than the boom judged by the extent of changes in general marital fertility rates. Whereas fertility rose by 23 percent between 1976 and 1986, it fell back by as much as 53 percent in the next intercensal period of 1986-96 (the fall was even more drastic in the five year period 1991-96 compared to 1986-91).

Second, the rise of fertility in the boom period was visibly concentrated among higher age cohorts (above 25 but even more significantly among those above 35 years of age). In other words, again it appears as if the general fertility rise in this period is not driven by increased marital fertility among the young – a factor that reinforces the earlier point about the relative unimportance of the marital patterns of the young as a possible contributory factor to baby boom.

Third, the bust period is associated with a pervasive and near universal fall in marital fertility rates across all age cohorts. But even here, it appears that the extent of the fall was more significant among older women. By 1996, in fact, marital fertility for all age groups had recovered to well below their pre-boom levels particularly in the case of older women.

In summary, this section has highlighted a number of interesting patterns about both periods. Regarding the boom, we can say that it was at least in part caused by population momentum from an earlier period (namely, changing age structure). Furthermore, it could have been even more drastic had the favorable official ideology and policy of encouraging marriages translated into real terms practice of increased and/or early marriages among the young. And last, but not least, it was increasing fertility among older women (rather than the young), which fuelled this process.

With respect to the bust, the above analysis has suggested that delayed marriages and decreasing marital fertility among all age groups have been the primary movers of changes in birth rate, but also interestingly that there is now a significant population momentum (reflecting the 1980s' baby boom), which can exert substantial upward pressure on fertility in the years to come.

4.2 Decomposition Analysis

In this section, we adapt the framework introduced above in order to standardize for changes in CBR caused by each of the four components discussed earlier. In this way, we can isolate and account for, more systematically, the effects of each of these factors on fertility changes in the periods under discussion.

The standardization technique uses CBR (or general fertility rate, GFR) as a proxy for total fertility rate (TFR), for which consistent time-series data are not always available. It is based on an expression of CBR as given in equation (1) above. However, since it is concerned with accounting for *changes* in the birth rate (or GFR), it operates in terms of, and focuses on, partial changes in each one of the proximate components (keeping others constant). It can, therefore, allow us to assess the role of each of these factors in bringing about changes in CBR over a given period. Since socio-economic and policy factors operate through marriage behavior and marital fertility, any attribution of change to these two can be of particular interest in explaining possible causes of population boom and bust.

The procedure for decomposition is spelt out in Table 6. These formulae are derived on the basis of a number of simplifying assumptions[15], and in general relate changes in each specified component to changes in CBR in a *ceteris paribus* fashion.

Table 7 reports the results of the standardization exercise. This includes an indication of both absolute and relative contributions of the specified components to changes in CBR. The results are obtained through detailed calculations involving the computation of age-specific marital fertility rates, which are imputed from age-specific fertility rates in general, for which data are more readily available. However, since there are diverse and sometimes varied estimates of these, we have in most cases taken a mean of the most credible estimates including various estimates of birth rates (see explanations to Table 1-5). To control for errors, the results are subjected to a 'consistency test', which checks to see if the CBR equation (1) above holds. In practice, this can yield a different or 'accounted for' CBR compared to the 'observed' CBR. The discrepancy can arise from errors and imprecision in estimations used for each of the four components and/or reflect the influence of the 'joint effects', which are excluded by the nature of the assumptions made here (see above).

Moreover, since the choice of the base period for measuring change can make a difference (see UN, 1989), results are shown for both periods 1 and 2 that are used alternatively as base periods[16]. In general, however, there appears to be broad conformity between the two sets of estimates reported in Table 7 for comparison purposes and also the discrepancy between CBR accounted for by the four components and those observed (from published data) appear to be well within an acceptable band of ±10 percent indicating generally robust results.

In general, the results here appear to confirm the observations made in the last section. Changes in marital fertility are by the far the most important single factor oiling change in general fertility both during the up and the down cycles (boom or bust periods). During the first ten-year intercensal period (1976-86), this element accounted for more than 118 percent of the perceived fertility rise (in practice, of course its effect was moderated by the downward influences of marital status and the proportion of women in total population giving a combined effect of almost –40 percent). During the bust too it has been apportioning more than 90 percent of the fall in CBR in each of the two five-year periods after 1986. By contrast, the marital status factor has been a consistently moderating element. That is to say, whether during the boom or bust, this factor has acted as a brake on fertility (accounting for about a fifth or 21-23 percent of the overall change).

One implication of this is that the boom would have been even more pronounced had it not been for a moderating effect of changes in marital status. Similarly, the bust would not have been as drastic were it not for the strong downward contribution of this factor. Combined together, therefore, both 'behavioral' factors (marital status and marital fertility) appear as significant movers of the rise and fall of fertility in both periods.

As for structural/demographic factors, too, the results appear to confirm the earlier discussion. We can see that changes in age structure contributed positively to the population surge in the boom period. About 30 percent of the rise in CBR in this period can in fact be attributed to the population momentum from earlier on. Thus, it would be wrong to attribute the entirety of the baby boom to a surge in fertility alone. At least some of the dynamics of the population swing in this period are related to past population factors and should have been better anticipated.

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[15] The first assumption is that of *additivity* (i.e., the four components can be added and subtracted in order to assess the individual effect of each component). This is despite the fact that these appear as products in the equation. The second concerns functional independence (that the four components are not inter-related) so that the summation of the role of individual components can take place without 'too much risk of adding overlapping effects.' These assumptions are spelt out and fully discussed in Bogue *et al* (1993: 25-277).

[16] For instance, over the 1976-86 period, change is first measured with respect to the 1976 data as benchmark data and then again with the 1986 data. Same practice has been applied to other intercensal periods.

On the other hand, the proportion of women in reproductive ages initially acted a moderating factor during the boom but has since changed signs and is now a contributory factor to (potential) fertility rise. It is not clear to what extent this is due to the 1980s' baby boom, but what it does indicate is that this phenomenon can potentially threaten fertility transition in the future.

5. A Critical Appraisal

The picture thus far, supported by the standardization analysis, seems to suggest that the so-called 'behavioral components' of CBR were important factors behind the Iranian experience of fertility rise and fall. Although less prominent, the so-called demographic/structural factors, nevertheless, indicate interesting issues and patterns, too.

First, some of the boom was due to population momentum and not just short-term changes in the demographic behavior of couples. Second, due to a recent and somewhat unexplained shift in the composition of population in favor of women of reproductive ages (rising from 22 percent of the total population in 1976 to 24.4 percent in 1996; see table 3), there is now a potential threat to the current process of fertility fall, which can initiate a future baby boom.

On the other hand, the prominence of marital status and marital fertility underscores the importance of the social, economic and institutional environment in which fertility is intermediated by both socio-economic factors affecting demand for children as well as supply-side measures such as family and population policies pursued after the Revolution.

This section aims to take the discussion one step further by revisiting the earlier evidence on the boom and bust and interrogating, it in light of some of the perspectives that have emerged so far. Given the paucity of data, we have relied on a number of direct and indirect indicators to shed light on the dynamics and characteristics of the rise and fall in fertility. In what follows, we focus on available quantitative evidence on new births and population of the young in an attempt to locate the beginning and end of the boom and bust phases and to relate them to economic and institutional changes taking place in Iran. In studying these, we will need to bear in mind the important landmarks and developments of the period. These are: the Revolution in 1979, the war (with Iraq) 1980-88 and the beginning of a population policy U-turn from 1988 onwards.

Figure 2 is based on annual registered births collected by Iran's Civil Registration Organization (CRO). Despite the well-known weaknesses of the vital statistics, this is the most direct evidence of population increase in Iran and can provide a useful indication of the trend line and variations in officially-registered births over time (see Hakimian, 2000 for a discussion of the shortcomings of these data). In fact, the data here depict a unique and rapid jump in births registrations some time in the late 1970s.

Annual population increments climbed to a peak of almost 2.5 million in 1980 and 1981, but the momentum behind population growth can be traced even earlier. Registrations in the first two years of the Revolution shot up significantly for the first time in 1979 and 1980 (each by 24 percent and 45 percent, respectively). What is interesting is that, taking account of the normal conception period, this trend appears to suggest that the initial momentum for the baby boom may have in fact shaped up as early as in 1978, that is, during the tumultuous period *leading* to the Revolution and prior to the change of the regime. After that, absolute population increments remained high until 1986 after which they began to fall sharply. By the mid-1990s, they had almost regained their mid-1970s levels.

This evidence appears to suggest that neither war nor changes in *official* population and family planning policies provide adequate explanations for the *genesis* of (rather than the momentum behind) the baby boom and bust in Iran (war with Iraq ended in 1988 and the reversal of population policy only began after 1988). This preliminary conclusion has of course to be qualified by the fact that errors, overlaps and spurious fluctuations make individual or single data points in this respect less reliable than the indicated trend line and we should therefore exercise caution in deriving any conclusions from the evidence based on vital statistics. However, further evidence compiled from census data appears to convey a similar message.

Figures 3, 4 and 5 use census data to depict Iran's population dynamics from different perspectives. Figure 3 shows annual percentage changes in Iranian children aged 0-4 between 1967 and 1996. This too confirms a clear and sharp jump in the population growth tempo in the late 1970s. It can be seen that a moderately declining trend of the early 1970s was suddenly reversed in 1978, when the annual growth rate of the number of young Iranians jumped to 6 percent (it had been under 2 percent in much of the previous decade). Thereafter, the population growth tempo stayed high until 1986 when a sudden and sharp fall put an end to the booming number of the young. Evidence of baby bust is particularly manifest in sharp falls in the growth rates achieved in 1986 and 1987 but also sustained thereafter. As we have seen, dramatically reversing the baby boom of less than a decade earlier, the growth rate of this cohort of population has continued to fall sharply, edging to –6 percent per annum since 1992.

Figure 4 examines the evolution of fertility in Iran as measured by child-woman ratio (CWR, children aged 0-4 years per 1000 women). This too appears to suggest an even

earlier date for the beginning of the boom phase. After charting a well-established declining course before the Revolution, CWR appears to edge up beginning in 1977 (two years before the Revolution). It reaches its peak in 1985, after which the decline phase sets in. Starting with 1986 and continuing thereafter, fertility has been on a sharp and sustained declining path in Iran.

Last, but not least, a similar perspective emerges in Figure 5, which is based on an analysis of age profiles from census data (see Hakimian, 2000). This method is based on the conversion of the single file age data from the 1986 and 1996 censuses into the corresponding years of births and then tracking each year's share in the total population enumerated in these two census years. Here too, we can see a similar picture with an indication of a clear proportionate rise in the number of those born between 1978 and 1984.

We can conclude this discussion by stating that according to a variety of indicators, the surge in population growth started sometime *before* the Revolution (possibly in 1978 or even earlier in 1977) and came to an end around 1984-86. If correct, the timing of the boom and bust suggested here seems to cast doubt on the primacy of either war or changes in *official* population policy in *initiating* the boom and bust cycles in Iran. This does not of course preclude the possibility that either factor may have played a contributory role in maintaining the boom and bust *momentum* after it had gotten under way.

6. Summary and Conclusions

Common explanations of demographic change in Iran in the post-revolutionary period have focused on socio-economic developments on one hand, and supply-side policies, on the other. Given a near perfect match between population policy and fertility cycles (a succession of pro- and anti-natalist policies coinciding with the rise and fall of fertility), it has been particularly tempting to attribute the boom and bust cycles to the pervasive influence of policy changes in Iran after the Revolution.

This paper has found a number of surprising results and challenged common thinking on the behavior and determinants of change in population in Iran.

First, the standardization analysis conducted here has suggested that the role of structural factors may have been hitherto neglected in explanations of the dynamics of the boom. While policy-induced factors did matter more than the structural factors overall, a significant part of the drive behind the boom was, nevertheless, accounted for by population momentum from before the Revolution. This appears to suggest that even in the absence of social, institutional and ideological changes associated with the Revolution, Iran would have experienced a 'boom' of some sort due to its demographic structure. This is somewhat confirmed by our further analysis indicating that the initial stages of the population swing may be in fact traced to before the Revolution.

Second, our analysis has also made it clear that while clearly important, policy changes did not always have the intended or expected outcomes. Despite much ideological emphasis and official encouragement, marriage trends have followed a downward secular trend (especially among young Iranian women) – consistently acting as a moderating element on fertility, whether in the boom or in bust phases.

Last, but not least, a re-examination of the evidence on boom and bust seems to throw doubt on any suggestions of a one-to-one relationship between changes in population policy and fertility behavior. Neither war nor changes in *official* population and family planning policies appear as strong explanations of the start of the boom and bust cycles. The initial stages of population surge seem to have preceded the Revolution – or war – and the slowdown was in force before vigorous family planning programs were reintroduced in the late 1980s and early 1990s.

This in turn casts doubt on any notions of 'social engineering' constructed around a direct and unambiguous relationship between population policy and fertility change. In the Iranian case, at least, there is reason to believe that policy factors more likely contributed to the dynamics of population change rather than initiating the boom and bust cycles.

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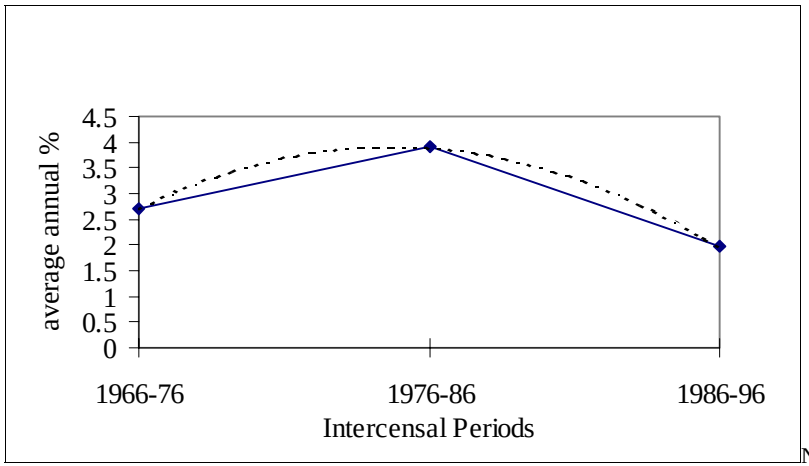
Figure 1: Iran - Population Growth Rate, 1966-96

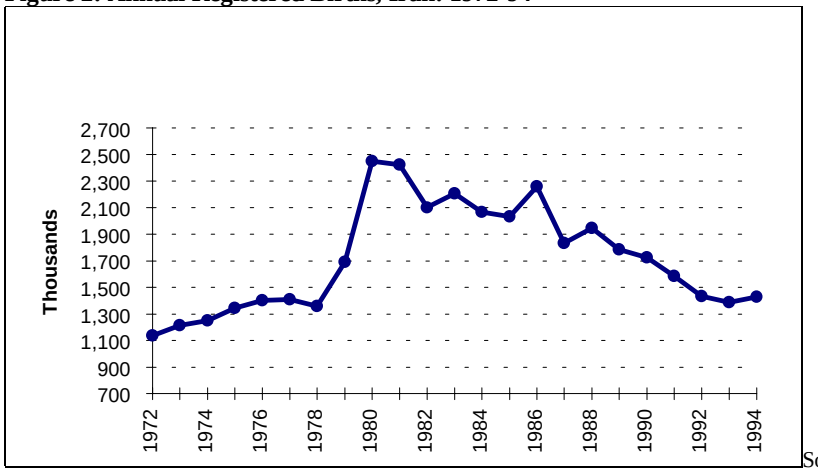


Notes:

-------- fitted trend line

Source: Based on SCI census data.

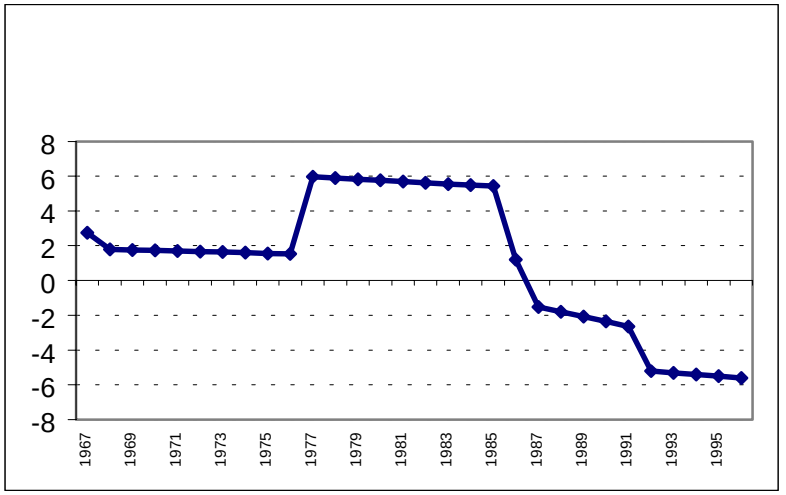
Figure 2: Annual Registered Births, Iran: 1972-94



Source:

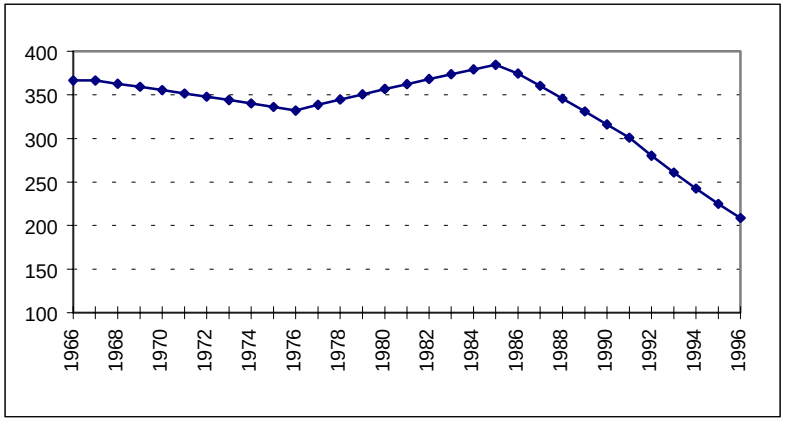
Based on data from the Civil Registration Organization in Hakimian (2000: 196)

Figure 3: Annual % Change in Iran's Population of Children Aged 0-4, 1967-96



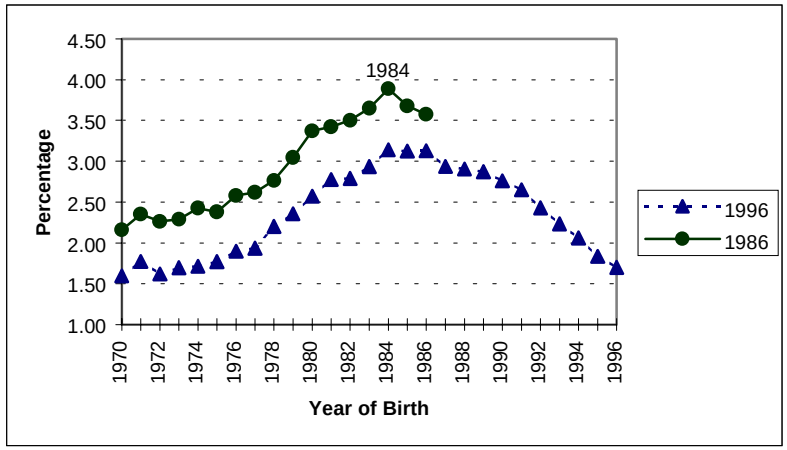
Source: Calculated from PDS (1998).

Figure 4: Child-Woman Ratio, Iran: 1966-96. (children aged 0-4 years per 1000 women of all ages)



Source: Calculated from PDS (1998).

Figure 5: Population by Year of Birth as % of Total Enumerations in 1986 and 1996



Source: Calculated from census data as in Hakimian (2000: 197).

Table 1: Summary Demographic Data: Iran, 1976-96

	1976	1986	1991	1996
Total population ('000)	33,709	49,445	55,837	60,055
Average annual growth rate (%)[a]	2.71	3.91	2.46	1.47
Net average annual increment ('000) [a]	790	1,570	1,280	840
Sex ratio[b]	106	105	106	103
% Urban	47	54.3	57	61.3
0-4 Age group as % of total	16.1	18.3	14.6	10.3
Child-Woman ratio (CWR)[c]	732.5	857.9	667.9	420.4
Average annual change in CWR (%)[a]	-	+1.6	-4.9	-8.8

Notes: (a) Intercensal periods, ten-yearly for 1976 and 1986, and five-yearly for 1991 and 1996. (b) (Males per 100 Females). (c) Children aged 0-4 per thousand women of reproductive ages (15-49).
Sources: SCI, various census publications.

Table 2: Population Growth and Fertility in the Middle East & North Africa (1980s and 1990s)

		Population Growth Rate		Birth Rate[a]			Total Fertility Rate[b]		
	mid-1980s[c]	1998	Ave. Change (% p.a.)	1987	1998	Ave. Change (% p.a.)	1987	1998	Ave. Change (% p.a.)
Algeria	3.1	2.1	-2.9	35.5	25.9	-2.8	5.3	3.5	-3.8
Bahrain	4.2	3.6	-1.0	32.8	20.3	-4.3	4.3	3.4	-2.2
Egypt	2.6	1.7	-3.0	35.1	24.2	-3.3	4.3	3.2	-2.8
Iran	**3.8**	**1.7**	**-6.1**	**38.0**	**22.0**	**-4.8**	**5.7**	**2.7**	**-6.5**
Iraq	3.3	2.2	-3.2	40.3	32.5	-1.9	6.2	4.6	-2.7
Israel	1.5	2.2	2.6	22.7	21.9	-0.3	3.0	2.7	-1.2
Jordan	3.7	2.8	-2.1	38.5	31.0	-2.0	5.8	4.1	-3.1
Kuwait	3.9	3.1	-1.8	28.1	23.0	-1.8	3.9	2.8	-3.0
Lebanon	2.0	1.6	-1.9	27.9	21.2	-2.4	3.4	2.4	-3.0
Libya	4.1	2.2	-4.7	39.9	28.8	-2.9	6.2	3.7	-4.6
Morocco	2.2	1.7	-1.9	35.6	25.1	-3.1	4.4	3.0	-3.4
Oman	3.8	2.0	-4.8	43.0	28.8	-3.6	8.4	4.6	-5.3
Qatar	7.3	3.0	-6.8	26.7	14.2	-5.6	4.7	2.7	-4.8
Saudi Arabia	5.4	3.3	-3.7	37.3	34.1	-0.8	6.8	5.7	-1.6
Syria	3.2	2.5	-1.8	42.7	29.1	-3.4	6.6	3.9	-4.7
Tunisia	2.7	1.3	-5.5	29.2	17.9	-4.4	3.9	2.2	-5.0
UAE	3.6	5.4	3.2	27.9	17.5	-4.2	4.6	3.4	-2.7
Yemen	3.1	2.8	-0.7	52.0	39.9	-2.4	7.7	6.3	-1.8
Turkey	2.4	1.5	-3.6	30.0	21.1	-3.1	3.5	2.4	-3.3
MENA	**3.2**	**2.1**	**-3.4**	**37.5**	**26.7**	**-3.0**	**5.3**	**3.5**	**-3.6**

Notes: (a) Crude birth rate, per 1,000 people. (b) TFR: the total no of children a woman is likely to have during the whole span of her productive age (15-49) assuming she experiences age specific fertility rates observed in a particular period. (c) Average for the period 1984-86.
Source: World Bank (2000).

Table 3: Age Distribution of Iranian Women of Reproductive Ages (15-49) by Cohorts, 1976-96

	(% of total in each year of enumeration)			
	1976	**1986**	**1991**	**1996**
15-19	24.04	24.02	23.39	24.12
20-24	19.58	19.83	19.91	18.11
25-29	14.86	**17.19**	16.35	15.98
30-34	11.66	**13.72**	14.15	13.42
35-39	10.81	10.18	11.52	11.97
40-44	10.44	7.79	8.29	9.42
45-49	8.61	7.27	6.40	6.98
Total (Females aged 15-49)	100.00	100.00	100.00	100.00
Total number of women aged 15-49	7,412,219	10,546,568	12,199,349	14,666,631
Intercensal change (%)	-	42.3	15.7	20.2
Share of women aged 15-49 in:				
Total population	0.220	0.213	0.218	0.244
Total female population	0.453	0.436	0.451	0.496

Sources: Calculated from SCI, various census publications.

Table 4: Distribution of Married Women in Iran by Age Cohorts, 1976-96

	(% of total in each cohort)			
	1976	**1986**	**1991**	**1996**
15-19	33.88	33.20	**25.03**	**17.63**
20-24	77.54	**72.60**	**66.84**	**59.79**
25-29	91.53	90.00	86.62	83.85
30-34	94.62	92.10	92.45	91.25
35-39	94.43	92.20	93.45	93.00
40-44	91.05	90.10	91.93	92.07
45-49	86.22	83.70	89.40	89.38
Share of married women in				
Total female population (%)	75.1	73.0	70.5	66.8

Notes: For 1991 and 1996 figures are adjusted to incorporate women of unknown age on the basis of the assumption that they had the same age distribution as that of the general population. Also adjusted for women of unknown marital status on the assumption that they had the same marital status distribution of their age group.

Sources: 1986 data from Aghajanian (1991: 708); it does not adjust for women of unknown marital status. For marriage data 1991, Salnameh (1372: 49); otherwise calculated from SCI, various census publications.

Table 5: Changes in Marital Age-Specific Fertility Rates in Intercensal Periods in Iran, 1976-96

	Martial ASFR (per 1000 women)				Intercensal Change (%)			
	1976	**1986**	**1991**	**1996**	**1976-1986**	**1986-1991**	**1991-1996**	**1986-1996**
15-19	384.6	418.7	308.8	334.7	8.8	-26.2	8.4	-20.0
20-24	392.9	422.9	347.8	272.6	7.6	-17.7	-21.6	-35.5
25-29	319.7	358.9	304.2	188.4	12.2	-15.2	-38.1	-47.5
30-34	248.4	311.3	232.6	125.5	25.3	-25.3	-46.0	-59.7
35-39	180.0	278.0	165.9	87.1	54.4	-40.3	-47.5	-68.7
40-44	90.1	137.2	82.7	47.2	52.4	-39.8	-42.8	-65.6
45-49	32.9	58.1	23.5	21.8	76.9	-59.6	-7.1	-62.5
General Marital Fertility Rate	254.7	313.0	231.7	149.1	22.9	-26.0	-35.7	-52.4

Age-specific fertility rates from a wide variety of sources have been used to estimate the required marital age-specific fertility rates in this table. Numbers of married females have been adjusted for those of un-known age and marital status and unknown age.

Sources: Calculated from various sources cited in SCI (1993: 73 and 75); Aghajanian (1991:709) and Aghajanian and Mehryar (1999a: Table 5).

Table 6: Procedure for Decomposition of Changes in Birth Rate

Change in CBR attributed to changes in each one of the four components	**Procedure**
Demographic/Structural factors:	
Proportion of women of reproductive ages in total population	$\text{GFR} \cdot \left(\frac{W_2}{P_2} - \frac{W_1}{P_1}\right)$
Age structure of women of reproductive ages	$\left(\frac{W_1}{P_1}\right)\left[\sum_i (A_{2i} - A_{1i}).M_{1i}.F_{1i}\right]$
Behavioral Factors:	
Marital status distribution	$\left(\frac{W_1}{P_1}\right)\left[\sum_i A_{1i}.(M_{2i} - M_{1i}).F_{1i}\right]$
Marital fertility	$\left(\frac{W_1}{P_1}\right)\left[\sum_i A_{1i}.M_{1i}.(F_{2i} - F_{1i})\right]$

Note: Subscript i refers to age-cohorts within the reproductive ages band of 15-49; subscripts 1 and 2 refer to intercensal periods 1 and 2 over which change is being measured. For a description of the other notations, see the text above.

Source: For derivation of these formulae, see Bogue et al (1993: Table 1, 25-276).

Table 7: Attribution of Changes in Crude Birth Rate in Iran to Specified Components: 1976-96

	First year given as the base period						Second year given as the base period					
	Absolute change			Share in total change (%)			Absolute change			Share in total change (%)		
Change in CBR accounted for by:	**76-86**	**86-91**	**91-96**	**76-86**	**86-91**	**91-96**	**76-86**	**86-91**	**91-96**	**76-86**	**86-91**	**91-96**
Age structure	1.93	0.32	-0.97	+29.0	+2.5	-8.6	1.84	0.15	-0.72	+27.6	+1.1	-6.3
Marital status	-1.43	-3.03	-2.64	-21.4	-23.2	-23.2	-1.64	-2.40	-2.57	-24.6	-18.5	-22.6
Marital fertility	7.90	-11.61	-10.96	+118.7	-89.1	-96.3	7.48	-11.51	-11.63	112.3	-88.3	-102.1
Proportion of women of reproductive ages in total population	-1.26	1.18	4.20	-18.9	+9.1	+36.9	-1.51	0.85	2.56	-22.6	+6.5	+22.5
Total change accounted for	7.15	-13.13	-10.37	+107.3	-100.8	-91.1	6.18	-12.92	-12.36	+92.8	-99.2	-108.5
Observed change in CBR	6.66	-13.02	-11.39				6.66	-13.02	-11.39			
(% explained)	(107.3)	(100.8)	(91.1)				(92.8)	(99.2)	(108.5)			