HACETTEPE UNIVERSITY INSTITUTE OF POPULATION STUDIES
ECONOMIC AND SOCIAL DEMOGRAPHY PROGRAM

# THE ANALYSIS OF TEMPO AND QUANTUM COMPONENTS OF PERIOD FERTILITY IN TURKEY

Tuğba ADALI

M.A. thesis submitted for the partial fulfillment
of the requirements for the M.A. degree in
Economic and Social Demography Program at Hacettepe University
Institute of Population Studies

Ankara
August, 2007

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Ankara
August, 2007

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# ACKNOWLEDGEMENTS

I am thankful to my supervisor first of all, Assoc. Prof. Dr. İsmet KOÇ, for the advice and support he has provided me with throughout the preparation of this thesis.

I am grateful to Mehmet Ali ERYURT for kindly answering my each and every question, and to Dr. Tomáš SOBOTKA, for not hesitating to reply the e-mails from a master's student abroad. I also thank Erhan ÖZDEMİR and Sutay YAVUZ for their deliberate efforts to broaden my point of view, as well as my friends Fulya Hande TUNÇKANAT and Pelin ÇAĞATAY for making the best they can to help and keeping me company. I am also thankful to my proofreader and dear friend Meltem DURAN, for giving me a hand from distances far away.

I especially express my gratitude to Yakup PEKÖN for keeping me in high spirits, as well as for his kindness and patience. I additionally thank Meral YARIMBAŞ, Hilal DEMİR and Mert Seymen RENKMEN, for being such good friends.

I finally thank my mother, Sebahat ADALI, for her daily moral support over the phone.

## SUMMARY

The widely used period fertility indicator Total Fertility Rate (TFR) is a measure that has certain disadvantages. One of them is that it is subject to tempo distortions caused by the changes in the timing of childbearing. Bongaarts and Feeney (1998) have proposed an adjustment procedure to correct TFR for such distortions using changes in the mean ages at childbearing by birth order, to calculate an adjusted TFR that reflects the level of fertility that would have been observed in the absence of changes in timing.

Studies regarding tempo effects are widely focused on developed countries in literature, very few studies are available for developing ones. Turkey has been experiencing fertility decline since the 1960s, many changes have accompanied this decline, including increasing mean ages at childbearing. This fact suggests that studies regarding tempo effects are also necessary for developing countries.

Another focus of the thesis is to calculate tempo effects for basic selected variables, namely, type of place of residence, region, migration status, mother tongue and educational attainment, to find out whether groups of women differ in their participations to fertility postponement. In other words, the thesis examines whether the total fertility rates of women of different characteristics are more influenced by tempo effects or not.

The adjustment proposed by Bongaarts and Feeney (1998) is applied on the data sets of the three successive demographic surveys, the Turkish Demographic and Health Surveys of 1993, 1998 and 2003. The findings suggest that there exists increases in mean ages at childbearing, thus such an approach may actually be necessary for Turkey. Additionally, findings show that there are differences in tempo effects with respect to categories of women for different variables, although some differences are small.

# ÖZET

Yaygın olarak kullanılan dönem doğurganlık göstergesi Toplam Doğurganlık Hızı (TDH) çeşitli hatalara açık bir ölçüttür. Bu hatalardan bir tanesi doğurganlığın zamanlamasındaki değişimlerden ileri gelen tempo etkisidir. Bongaarts ve Feeney (1998) TDH'nı pariteler bazında bu etkilerden arındırmak için bir düzeltme yöntemi önermişlerdir. Bu yöntemle hesaplanan düzeltilmiş TDH doğurganlık zamanlamasında değişiklik olmaması durumunda gözlemlenecek olan TDH düzeyini göstermektedir.

Tempo etkileriyle ilişkili çalışmalar literatürde yaygın olarak gelişmiş ülkeler için bulunmaktadır, gelişmekte olan ülkeler için çalışmalar oldukça az sayıdadır. Türkiye'de 1960'lı yıllardan beri doğurganlıkta düşüş gözlenmektedir, ve bu düşüşe eşlik eden değişimlerden biri de artan ortalama doğum yaşındaki artışlardır. Bu bilinen gerçek tempo etkilerinin gelişmekte olan ülkeler için de çalışılmasının gerekli olduğunu düşündürmektedir.

Tezin başka bir odağı da tempo etkileri seçilmiş bazı temel değişkenler temelinde hesaplamaktır, bu değişkenler yerleşim yeri tipi, bölge, göç durumu, anadil ve eğitim durumudur. Değişkenler esas alınarak düzeltmelerin amacı değişik kadın gruplarının doğurganlık ertelenmesinde farklılık gösterip göstermediğini görmektir. Başka bir deyişle, bu tez değişik özelliklerdeki kadınların toplam doğurganlık hızlarının tempo etkilerine ne farklılıkta maruz kaldıklarını incelemektedir.

Bongaarts ve Feeney (1998) tarafından önerilen düzeltme yöntemi birbirini takip eden üç demografik araştırmanın verilerine uygulanmıştır: 1993, 1998 ve 2003 yıllarının Türkiye Nüfus ve Sağlık Araştırmaları. Bulgular ortalama çocuk doğurma yaşında artışlar göstermektedir, buna bağlı olarak tempo etkileriyle ilgili bir bakışın gerekli olduğu ortaya çıkmaktadır. Ek olarak, farklı değişkenlerin kategorilerine göre tempo etkilerinin değiştiği gözlenmiştir, ancak bu değişiklikler bazı değişkenler için küçük çıkmıştır.

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# CHAPTER 1
# INTRODUCTION

Turkey has been going through fertility decline since the mid 20th century. As would be expected during fertility transition, many social and economic changes affecting women have accompanied the decline in fertility. Changes such as increasing enrollment in education and participation to labour force suggest that the timing of fertility should not remain constant in time, rather, it should be increasing.

The total period fertility of Turkey has declined from 6.1 in 1950s to just above the replacement level according to the results of Turkey Demographic and Health Survey 2003 (HUIPS, 2004). However it is known that period measures of fertility are influenced by changes in the timing of fertility, in other words by *tempo* changes. It is highly possible that period fertility measures of Turkey are not exceptional in this aspect due to reasons mentioned in the previous paragraph. Demographic data of Turkey support this possibility by showing increasing mean ages at childbearing accompanying the fertility decline over the years.

The period fertility measure, Total Fertility Rate (TFR) is the sum of age specific fertility rates, calculated by births in a year from a certain age group of women divided by the number of women in that age group. It forms a “synthetic cohort”, collecting information from different cohorts of women and combining them to form a single indicator. This indicator is a quantum measure that is subject to tempo distortions. A tempo distortion is defined as an undesirable inflation or deflation of a period quantum or tempo indicator of a life-cycle event that results from a rise or fall in the mean age at which the event occurs (Bongaarts and Feeney, 2005). The tempo distortion in the TFR is caused by the changes in the mean ages of childbearing. As women delay their childbearing, the number of births falling into a period of one year will reduce, causing a decrease in TFR, although the number of births per woman is the same, just with different timing. Therefore, keeping all other factors constant, if the mean age at childbearing increases and the number of births women give remain the same, TFR will still imply that women have less and less children, which is actually not true. The same problem arises when the mean age at childbearing decreases. This may not seem to be a common situation, but it may happen in the following way: The mean age at childbearing is a weighted average of mean ages at childbearing for all birth orders separately. The weights are the share of births that take place at certain parity. When parities of the large orders decrease in number, in other words, women start bearing fewer children, the weights of the last births (that usually happen in the older ages) decrease, and the mean shifts to the younger ages. Shortly, the mean age at childbearing can decrease even when all mean ages at childbearing for parities are increasing, because of changes in weights.

It is because of these reasons that the use of TFR may not be very representative of the real fertility women are experiencing. This is the topic of attention in this paper. In order to see if it is possible to mention tempo effect on TFR in Turkey, a brief check on TFR and mean age at childbearing (MAC) may be helpful. According to the Turkey Demographic and Health Survey reports, TFR has decreased from 2.65 in 1993 to 2.23 in 2003 (HUIPS, 1994; HUIPS, 2004). MAC, on the other hand, has increased from 26.70 to 27.16 in the same period. This suggests that MAC has a share in the TFR decline.

For the reasons mentioned in the previous paragraphs, there is a need to find out the actual period fertility level. Turkey might be experiencing higher fertility than indicated by TFR. Thus, studies are needed to reveal the tempo effect in period fertility.

In the light of the discussions above, this thesis intends to carry out such a study with the following aims:

- To examine the level and timing of fertility in Turkey on the basis of birth orders to find out if a tempo effect approach is really necessary,
- To try to reveal the tempo in recent period fertility by using a method suggested by Bongaarts and Feeney (1998) that claims to produce tempo free TFRs,

- To calculate tempo effects of different groups of women based on different variables, namely type of residence, region, migration status, mother tongue and education to find out whether tempo effects differ with respect to different groups, and if so, to see which groups are more likely to be responsible for tempo effects,
- To find out whether this method is applicable and useful in Turkey.

The thesis contributes to the literature on the topic in some aspects. One of them is that although there are studies on cohort fertility in Turkey, there has not been a study focusing directly on the effects of timing changes on fertility indicators. This thesis thus may provide a basis for further analysis. Another contribution of the thesis will be the application of the Bongaarts – Feeney Method on survey data. The applications of this method are mostly on developed countries with vital registration systems enabling annual analysis with respect to single ages. Since Turkey is in lack of such a system, only survey data is available. To overcome the problems that may arise due to use of survey data, some ways will be proposed to adopt the method, which is also not an issue of focus literature just yet. This fact also acts as a limitation to the study.

The organization of the thesis is as follows: The thesis begins with this introduction, which includes the justification, objectives and contributions of the thesis.. In the second chapter, the methodology is introduced. The data source, variables, the analytical method borrowed from Bongaarts and Feeney, the adoption of the method and its alternatives are included in the Methodology. This section is followed by Chapter 3, Theoretical Framework and Fertility Overview in Turkey, which aims to build a theoretical base for the thesis and briefly explain changes in fertility in Turkey. Chapter 4 gives the Literature Review, where studies on the subject are reviewed extensively. Results are presented in Chapter 5 in two sections. In the first section, descriptive results for Turkey will be given in terms of total fertility rate and mean age at childbearing, and in the second section, the results of the Bongaarts and Feeney Adjustment will be presented. The thesis is finalized in Chapter 6, where conclusion and discussions can be found.

# CHAPTER II
# METHODOLOGY

## 2.1 DATA

Three sources of data will be used in this thesis, and they are: the Turkey Demographic and Health Surveys of 1993, 1998 and 2003. They are described in section 2.1.1 below.

### 2.1.1 Demographic and Health Surveys of 1993, 1998 and 2003

Since 1968, there have been regular quinquennial surveys on demography and health in Turkey, carried out by the Hacettepe University Institute of Population Studies. Since Turkey does not yet have a vital registration system that allows certain demographic indicators to be obtained, and censuses do not provide detailed data, these surveys serve as the major demographic data source since their inception.

The last three surveys were completed as a part of the Demographic and Health Surveys program, which involves over 75 countries. The Turkey Demographic and Health Surveys are nationally representative surveys on major demographic issues such as fertility, child and infant mortality and family planning. Below are brief descriptions of these surveys.

#### 2.1.1.1 Sample Design

The Turkey Demographic and Health Surveys (TDHS) have complex sample designs: A weighted, multistage and stratified cluster sampling approach is used in all of them. Stratification is required to improve representativity of the sample by guaranteeing the geographical spread of it, and it additionally allows the calculation of indicators at the level of the strata.

In the 1993 and 1998 surveys, the five main regions of Turkey, namely West, South, Central, North and East are divided into a total of 14 sub regions, which all contain urban and rural regions within. Thus the samples of the 1993 and 1998 surveys are each made up of 28 strata. To sum up, these surveys provide various demographic indicators for the five main regions of Turkey in addition to information on the level of urban and rural types of residences.

The TDHS 2003 differs from the previous two surveys in some aspects. According to European Union Criteria, new statistical regions have been defined in Turkey. This regional classification is called The Nomenclature of Territorial Units for Statistics (NUTS), and it has three different levels. 81 provinces make up the NUTS 1 level, 26 regions are formed from these to make up the NUTS 2 level, and from these 26 regions, 12 regions are formed to be the NUTS 3 level. This survey provides information on NUTS 3 level. The traditional 5 region system does not fit into NUTS, but for the sake of continuity and comparability, they have been kept, with small changes that allow the making up of these 5 regions from the 12 NUTS 3 regions.

Resulting from these changes, the levels on which this survey gives information on are 12 NUTS 3 regions the five regions, urban and rural types of residence, metropolitan areas and earthquake areas. Additionally, İstanbul's slum and non-slum areas and Southeast Anatolia were given special attention. A total of 40 strata were formed as a result.

The sample allocation of the 1993 and 1998 surveys are similar. In 1993 TDHS, sampling errors from the previous survey (1988 Turkish Population and Health Survey) for selected variables are combined with the power allocation technique (Bankier, 1988), and the same procedure is carried out in 1998 using the sampling errors for selected variables from the 1993 Survey. In the 2003 Survey, due to the changes introduced that are explained above, the overall sample size is increased by about 30%. The sample was allocated within the five regions similar to the previous surveys, however, İstanbul and Southeast Anatolia needed to be oversampled. Additionally, a minimum number of households were aimed for the NUTS 1 regions, so the overall allocation differs in this survey, the West and East regions have larger shares.

Cluster size was 20 households for all types of residence in the 1993 Survey. In the 1998 and 2003 surveys, 25 households were selected for urban segments and 15 were selected for rural ones. An exception was made in the 2003 Survey, 12 households were selected from the slum and non-slum segments of İstanbul.

All three surveys describe urban settlements as those having a population size larger than 10,000, and rural settlements the opposite, regardless of administrative status. The urban and rural frames of the 1993 Survey is obtained from the 1985 and 1990 Population Censuses, and that of 2003 Survey is obtained from the 2000 Census. The 1998 Survey uses the 1997 Population Count.

8619 households and 6519 women were interviewed in the 1993 Survey, 8059 households, 8576 women and 1971 husbands in the 1998 Survey, and 10863 households and 8075 ever married women in the 2003 Survey.

#### 2.1.1.2 Questionnaire Design

The types of questionnaires used in the three surveys differ in some aspects, but they all have a Household Questionnaire that lists the members of the household, obtains their brief demographic characteristics, and gets a profile of the house itself in addition to questionnaires applied to individuals.

The 1993 TDHS has two types of questionnaires: Household Questionnaire and Woman’s Questionnaire. The Woman’s Questionnaire is used on all women in the household that are ever married and below 50 years of age. It involves the following sections: respondent’s background, reproduction which obtains women’s fertility histories in detail, marriage, contraception which involves questions on knowledge and use, pregnancy and breastfeeding which is a section with questions on antenatal care, delivery and breastfeeding, immunization and health section that asks about the periods after delivery, fertility preferences section, background characteristics of husband and women's work, and a last one being values attitudes and beliefs.

The 1998 TDHS has four types of questionnaires; Household Questionnaire, Ever-Married Women Questionnaire, used on ever-married women of ages 15-49, Never-Married (Single) Woman's Questionnaire, used on never-married women of ages 15-49, and Husband Questionnaire, the existence of which makes this survey special, since it does not exist in the other DHSs in Turkey. After the listing of household members, all eligible women in the household were interviewed, and in a sub sample that is half of the original sample size of households, husbands were also interviewed.

The Ever-Married Woman's Questionnaire differs from the Woman's Questionnaire in some aspects. Woman's Work and Status is a different section in 1998, and an extra section of sexually transmitted diseases and AIDS is included. The Never-Married Woman's Questionnaire includes a section on respondent's background, sections on fertility, marriage, contraception and fertility preferences that aim to acquire the perceptions and attitudes of never-married women on these issues, in addition to migration, woman's work and status and sexually transmitted diseases and AIDS sections.

The 2003 TDHS has 2 types of questionnaires, Household Questionnaire and Ever-Married Woman's Questionnaire applied to women of 15-49. There is not a separate questionnaire for never-married women however, there is an additional module on them in the Household Questionnaire. The sections of the Ever-Married Woman's questionnaire are very similar to the ones of 1998 TDHS.

**Table 2.1.1** Summary of the questionnaire types and number of interviews in the TDHS

| Types of Questionnaires Used and Number of Interviews | | | | |
|---|---|---|---|---|
| Survey | Household | Ever-Married Women | Never-Married Women | Husband |
| 1993 | 8619 | 6519 | NA** | NA** |
| 1998 | 8059 | 6152 | 2424 | 1971 |
| 2003 | 10863 | 8075 | 4208* | NA** |

*Source: TDHS 1993, 1998 and 2003*

**The number of women interviewed using the never-married women module of TDHS 2003.*

*** Not available.*

Although the never-married women module is not as detailed as a separate questionnaire, it includes questions that make it possible to obtain some basic variables that exist in Ever-married Woman's Questionnaire, such as education, migration and mother tongue, as will be mentioned in detail in section 2.5.

Since 1998 TDHS has a never-married women questionnaire, and 2003 TDHS has a never-married women module in the household questionnaire, it is possible to use all women in the calculations of Total Fertility Rate (TFR) and adjusted Total Fertility Rate (AdjTFR). However, neither a questionnaire nor a module for never-married women is available in TDHS 1993, therefore a factor is used to inflate the number of ever-married women to all women for the calculation of TFR. This factor differs if one aims to calculate TFRs for subgroups, for the outcomes of a variable for instance. The use of this factor in variables is explained in detail in section 2.5.

## 2.2 ANALYTICAL METHOD

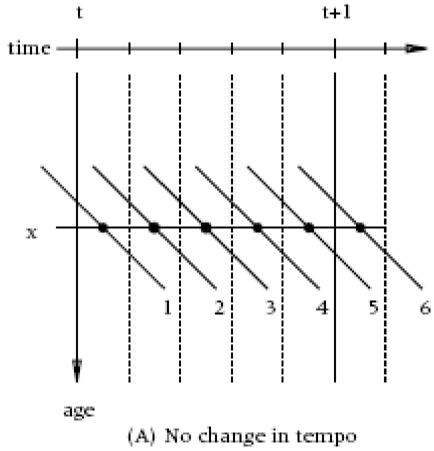
The analytical method used in this thesis is proposed by John Bongaarts and Griffith Feeney in 1998 in their article "On the Quantum and Tempo of Fertility". The study begins with a discussion on TFR, which is one of the most widely used indicators of fertility. It reflects the experience of a hypothetical cohort. The actual experience of a cohort however, is given by Cohort Fertility Rate (CFR), which has the disadvantage of reflecting past experience, since a cohort should complete childbearing for CFR to be calculated. This makes TFR more practical, since it gives a picture of current fertility levels. However, there are disadvantages regarding this indicator as well, one of them is that it is affected by changes in the timing of childbearing, making TFR higher or lower then it would actually be in the absence of these changes. Such changes are called tempo effects or distortions. How it arises will be explained in the following paragraphs and the discussions around it will be explained in Chapter 4.2.

The main aim of this thesis is to reveal the tempo effects on TFR if present in Turkey. Since Turkey is a developing country towards the end of its first demographic transition, fertility levels are decreasing. Additionally, it is likely that women are at some extent delaying childbearing, possibly due to improving educational status, increasing female participation in the labor force and urbanization. Hence, it is important to know whether fertility levels suggested by TFR are giving a real picture and whether fertility has gone down as much as it seems.

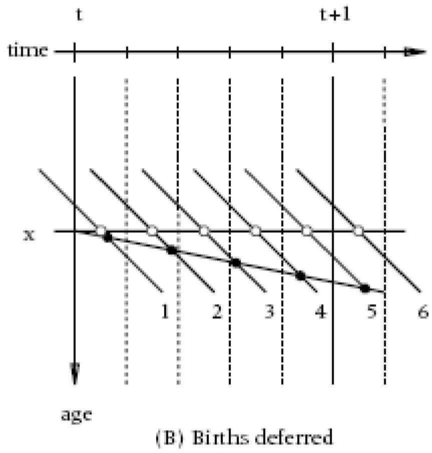
To illustrate how changes in the timing of childbearing work on TFR, a theoretical example by Bongaarts and Feeney (1998) will be given, whose assumptions are the following: (1) Only births of order one occur. (2) All women in every birth cohort have their births at a single exact age (x). (3) All births occur at equal intervals during the year (0,2 years) and (4) all cohorts have the same number of women. In the diagram below, t is the beginning of year t and t+1 is the end, the intervals are equal, each being 0,2 years, and the dots represent the times in which births occur, by different birth cohorts of women.

**Figure 2.2.1**. A hypothetical example

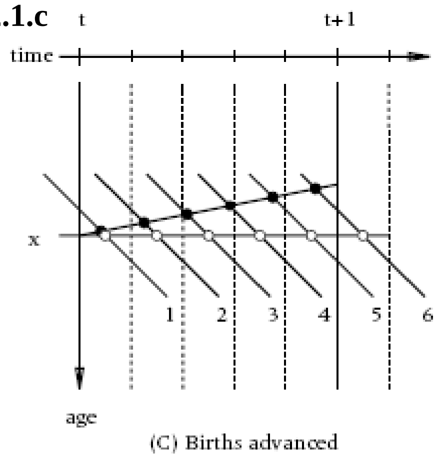
**2.2.1.a**




**2.2.1.b**




**2.2.1.c**




*Source: Bongaarts and Feeney (1998)*

The initial assumptions can be seen in Figure 2.2.1.a. There are five cohorts giving birth to 5 units of children during the year. If a rise of 0,2 years in the mean age at childbearing is introduced, the five units of births taking place in a year are evenly distributed throughout a period of 1.2 years. Thus, births by cohort 5 shift to year t+1, leaving 80% of the original number of births in year t. New timings of cohorts are calculated as follows:

$$u_{new} = \frac{u}{(1-r)}$$

where u is the time elapsed from time t to birth (e.g. 0.1 for cohort 1), and r is the change in mean age at childbearing (+0.2 in this case).

On the other hand, if a fall of 0.2 in the mean age at childbearing is introduced (Figure 2.2.1.b), the time period narrows down from 1 year to 0.8 years. Additionally, children born by cohort 6 fall into the last 0.2 year period of year t. Therefore, number of births during year t increases from 5 to 6 units, meaning a 20% increase in the number of births.

The example above forms the basis of the Bongaarts-Feeney adjustment. As seen in the example, in the case of a change in the mean age at childbearing, the number of births per unit time changes, although the number of children that will eventually be born remains the same. Bongaarts (1999) reaches three key conclusions from this example: "(1) Tempo distortions of period fertility occur during periods when the mean age at birth of a given order changes. (2) The size of the tempo distortion in a given TFR component depends on the annual change in the mean age of fertility at the corresponding birth order. (3) Tempo distortions have to be analyzed separately for each birth order."

Based on such information, the method (generally referred to as the B-F adjustment) aims to adjust the traditional TFR by using information on changes in mean age at childbearing to calculate an adjusted TFR that represents the "level of period fertility in the absence of changes in the timing of fertility", which means the quantum of period fertility. The difference between the two rates gives the tempo effect.

The calculation of the quantum and tempo of TFR is a simple procedure. After defining a period on which the adjustment is required, the mean age at childbearing for the beginning and end of this period are calculated. Their difference divided by the length of period in years gives the annual change in mean age at childbearing. Let mean age at childbearing be $x$.

$\frac{x_t - x_{t+a}}{a} = r$ where $r$ is the annual change in the mean age at childbearing. Then,

$AdjTFR = \frac{TFR}{(1-r)}$ Where $AdjTFR$ is tempo adjusted TFR value.

The authors state in a more recent article (2005) that the adjustment can be applied as mentioned, but they strongly suggest the use of every birth cohort separately, since ASFRs are subjected to distortions in fertility timing and changes in the shape of fertility schedule (Sobotka, 2003). This birth cohort perspective can be supported by reviewing the indicator mean age at childbearing. The mean age at childbearing is calculated from births of different orders. Bongaarts and Feeney (1998) demonstrate this by stating that mean age at childbearing can be expressed as a weighted average of mean age at childbearing for births of each order, for example:

$MAC = MAC_1 w_1 + MAC_2 w_2 + MAC_3 w_3 + MAC_{4+} w_{4+}$ where $w_i = \frac{TFR_i}{TFR}$

If higher order births decline more rapidly compared to lower order births, then $w_i$ s of higher order births decline too, reducing the share of ages at higher birth orders, thus reducing the overall mean age at childbearing. This means that, even if mean ages of separate birth orders are increasing, overall mean age may be decreasing if there are decreases in higher order births. Due to these reasons, using an overall mean age at childbearing may be misleading.

As a result, Bongaarts and Feeney give the following formula the full derivation of which can be found in the Appendix of Bongaarts and Feeney's study (1998):

$AdjTFR_i = \frac{TFR_i}{(1-r_i)}$ Where i = 1,2,3... as birth orders. Thus $AdjTFR = \sum AdjTFR_i$

The assumption of the model is that tempo changes are the same for births occurring at any age. To clarify, women of all ages and cohorts that give birth in year t postpone or advance their births to the same extent, the shifts are period-specific. By making this assumption, the model suggests that the shape of the fertility schedule remains the same, it only changes location. The discussions on this assumption will be given in section 4.2.

## 2.3 ALTERNATIVE METHODS

### 2.3.1 An Extension to the Bongaarts and Feeney Formula Including Variance Effects

As mentioned in Chapter 2.2, the Bongaarts and Feeney Adjustment has a critical assumption that the shape of the fertility schedule remains the same, in other words, variance effects are assumed to be absent. Kohler and Philipov (2001) have proposed an extension to this adjustment that includes these variance effects. Variance effects refer to the changes in the standard deviation of the fertility schedule, arising from the differences in postponements of childbearing of women of different ages.

The proposed method is based on the suggestion that in empirical application, increasing mean age at birth is often observed with increasing variance of fertility schedule. This suggestion is based on empirical evidence from some European countries. The authors state two important aspects of such increases in variance: First of all, they suggest this might be a characteristic of fertility declines in European countries. Secondly, they claim that such variances violate the assumption of the Bongaarts and Feeney Adjustment that requires the absence of changes in the shape of the fertility schedule. An additional claim is that mean age and adjusted TFR values are biased if variance effects are to be ignored. The authors state that such bias is most critical when the pace of change in the variance is increasing or decreasing over time. Therefore, they have developed an extension to the original method to relax the critical assumption of the Bongaarts and Feeney adjustment to allow changes in the shape of fertility schedule.

In order to carry out the calculation procedure of the model, two estimations should be obtained, $\delta$ , variance change, and $\gamma$ , tempo effect.

$\delta$ is estimated as $\hat{\delta}(t) = 0,25 \cdot \log(\sigma^2(t+1)/\sigma^2(t-1))$ for all years t, where $\sigma^2(t)$ is the observed variance of the fertility schedule in year t.

Further estimations require $\mu(t)$, the observed mean age, $\sigma^2(t)$, the observed variance, and $\kappa(t)$, the third centralized moment of the fertility schedule in year t, and the estimated variance change, $\hat{\delta}(t)$. Given these, the estimation procedure is as follows:

1. $\hat{\gamma}_0(t) = \frac{1}{2}\left[\mu(t+1) - \mu(t-1)\right]$ and $\hat{s}_0{}^2(t) = \sigma^2(t)$ are calculated for all years t,
2. $\hat{s}_n{}^2(t) = \sigma^2(t) + \left[\frac{\hat{\delta}(t)}{1-\hat{\gamma}_{n-1}(t)}\right]\hat{s}_{n-1}{}^2(t) + \frac{\hat{\delta}(t)}{1-\hat{\gamma}_{n-1}(t)}\kappa(t)$ is calculated for all years t,
3. $\hat{a}_n{}^2(t) = \mu(t) + \frac{\hat{\delta}(t)}{1-\hat{\gamma}_{n-1}(t)}\hat{s}_n{}^2(t)$ is calculated for all years t,
4. $\hat{\gamma}_n{}^2(t) = \frac{1}{2}\left[\hat{a}_n{}^2(t+1) - \hat{a}_n{}^2(t-1)\right]$ is calculated for all years t,
5. Step 2 is repeated until the convergence of the estimates,
6. The adjusted TFR with variance effects is calculated as $TFR(t)/(1-\hat{\gamma})$.

In short, it is suggested by Kohler and Philipov that although the Bongaarts and Feeney adjustment brings new insights, results obtained may be distorted in the presence of age-period interactions. However, using their alternative, such problem is avoided.

### 2.3.2. Tempo-Adjusted Period Parity Progression Measures

The Bongaarts and Feeney Adjustment is based on incidence rates, it uses age-specific fertility rates. However, as will be mentioned in detail in Chapter 4.2, there are some limitations to such an approach. One cannot use the adjusted TFR values to make conclusions on the completed fertility of the current cohorts of women for instance. Kohler and Ortega (2002) have thus developed a method based on occurrence-exposure rates that adjusts parity progression measures based on parity and age fertility model.

The authors mention two important purposes of these tempo-adjusted parity progression measures. One of them is that it provides a better indicator of period fertility by removing tempo distortions and parity composition effects from observed fertility. The other one is that it is possible to project the level, timing and distribution of the completed fertility of cohorts who have not reached the end of childbearing period with these measures, which is very useful for population projections and future analyses.

The empirical application of the method begins with calculating ASFRs and childbearing intensities. Childbearing intensities have the same nominators as ASFRs when calculated for a specific birth order, but exposures of women of corresponding parities in the denominators. Secondly, changes in mean and variances of period childbearing intensity schedules are calculated. From these, the annual variation of the mean age of childbearing is estimated, which is used to adjust the childbearing intensities. Finally, fertility measures of the synthetic cohort are obtained by the tempo adjusted childbearing intensities.

### 2.3.3. Other Methods

A study by Philipov and Sobotka (2006) proposes a simple method to adjust the total fertility rate in countries where data on births by parity is unavailable. This method is regression based, and it suggests regression coefficients for European countries, with the inclusion of Turkey. The coefficient given for Turkey is 1.5, and it is to be multiplied by the annual change in mean age at childbearing for year t to calculate the tempo effect for year t. The article does not include the calculations.

Both methods described above give adjusted period fertility indicators. Alternatively, other period indicators of fertility that may give better results than TFR may be used to reflect the current level of fertility. Such period fertility indicators do not use incidence rates, but rather occurrence exposure type rates.

One of these indicators is the fertility index based on age and parity life table (PADTFR), suggested by Rallu and Toulemon (1994). In fact, the Kohler and Ortega's adjustment is based on this indicator, their resulting indicator is the adjusted PADTFR. PADTFR is calculated from annual birth probabilities according to age, parity and time elapsed since last birth. Rallu and Toulemon (1994) claim that the underestimation of fertility quantum by TFR due to delays is a bias that can be eliminated by this measure. A study that uses this indicator by Barkalov (2005) states that a sample size of at least 40,000 maternity histories is needed for the calculation of this indicator.

Another indicator is the period average parity (PAP), which is the combination of the PATFR index for birth order 1 with the parity-progression ratios to second and later births based on duration birth intervals (Sobotka et al., 2005). This indicator is also considered to be less sensitive to changes in the timing of fertility than other (non-adjusted) period fertility indicators.

## 2.4 THE ADOPTION OF THE METHOD

The fact that Turkey does not have a vital registration system that allows the computation of fertility indicators, prevents the use of the Bongaarts – Feeney method on registration data. The TDHSs have birth history data which makes it possible to calculate TFRs and MACs for different birth orders. However, since using survey data instead of vital registration data means using smaller number of cases, it is more convenient not to make the adjustments annually, although it is theoretically possible.

An important point is that, since number of cases is limited due to use of survey data, single ages for women were not used in the calculations, but rather five year age groups, namely, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44 and 45-49. Additionally, no annual computations were made to keep the number of cases high.

This thesis uses two different approaches for selecting the time periods to be used for the adjustment. The first one is used by Bongaarts (1999) in an article which discusses tempo effects in the developing world. Another one is used by Lesthaeghe and Willems (1999) and Imhoff and Keilman (2000). A last approach is added by the author, the results of which are given in the appendix.

### 2.4.1. Time Periods Used by Bongaarts (1999)

In order to adjust a TFR value calculated using the five years preceding a survey, Bongaarts (1999) underlines that both the mean age at childbearing at the time of survey, and the mean age at childbearing exactly five years before the survey should be known. He adds that such precise estimates are not available, and he therefore suggests a three step procedure: (1) Subtracting the mean ages at each birth order as measured in the five year period of the previous survey from those measured in the recent survey, (2) Dividing these differences by 5 to obtain the annual change in means, (3) finally using these changes to obtain adjusted TFRs for the previous survey. The diagrams below show the use of time periods for the adjustments of five year TFRs of 1993 TDHS and 1998 TDHS:

**Figure 2.4.1.1** The use of time periods for the adjustment of TFR as by Bongaarts (1999), adopted to TDHS 1993

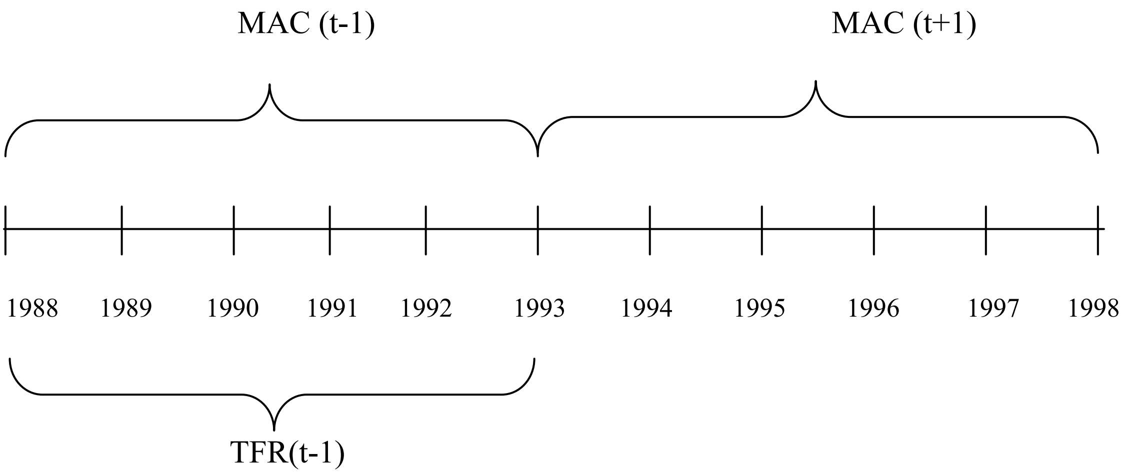
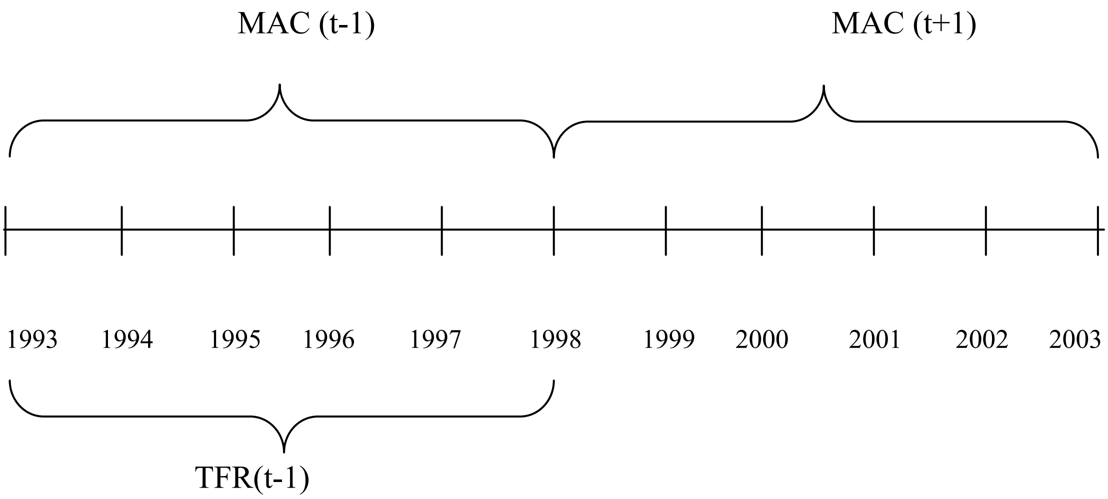



**Figure 2.4.1.2** The use of time periods for the adjustment of TFR as by Bongaarts (1999), adopted to TDHS 1998




### 2.4.2 Time Periods Used by Lesthaeghe and Willems (1999)

As will be mentioned in detail in 4.3.2, an article by Lesthaeghe and Willems (1999) includes an application of the Bongaarts and Feeney adjustment. As the figures they have given show, they have applied the reverse of Bongaarts (1999). They have used the difference in mean ages at childbearing of two successive periods, and have used it to adjust the TFR of the recent period. The application of this approach makes it possible to adjust the TFR values of 1998 in addition to 2003 TDHS.

**Figure 2.4.2.1** The use of time periods for the adjustment of TFR as by Lesthaeghe and Willems (1999), adopted to TDHS 1998

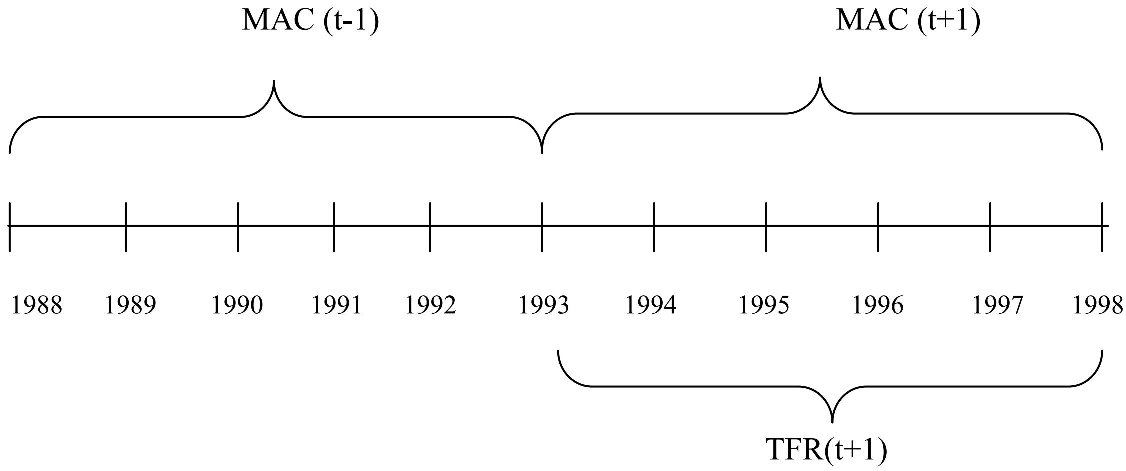
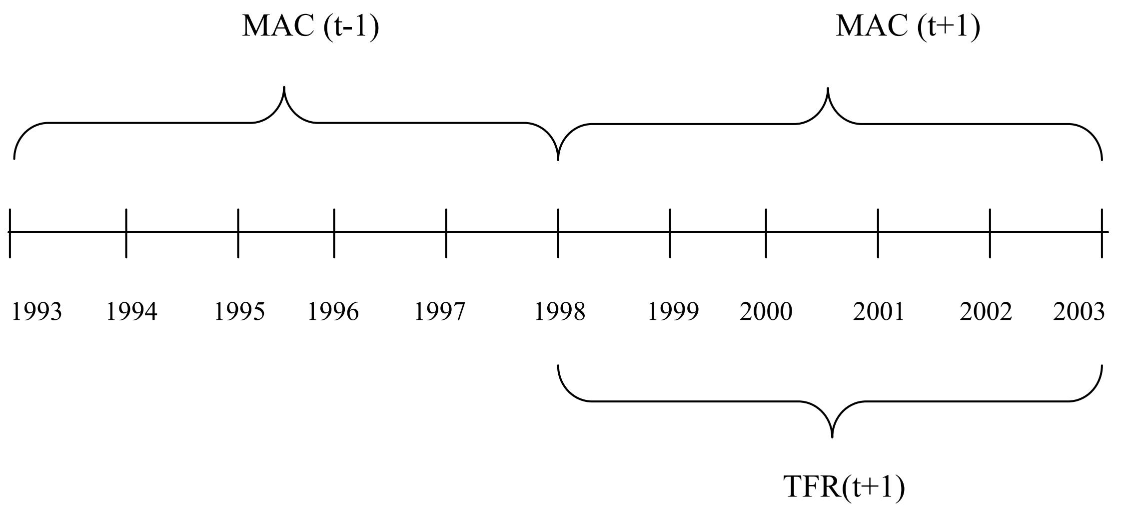



**Figure 2.4.2.2** The use of time periods for the adjustment of TFR as by Lesthaeghe and Willems (1999), adopted to TDHS 2003

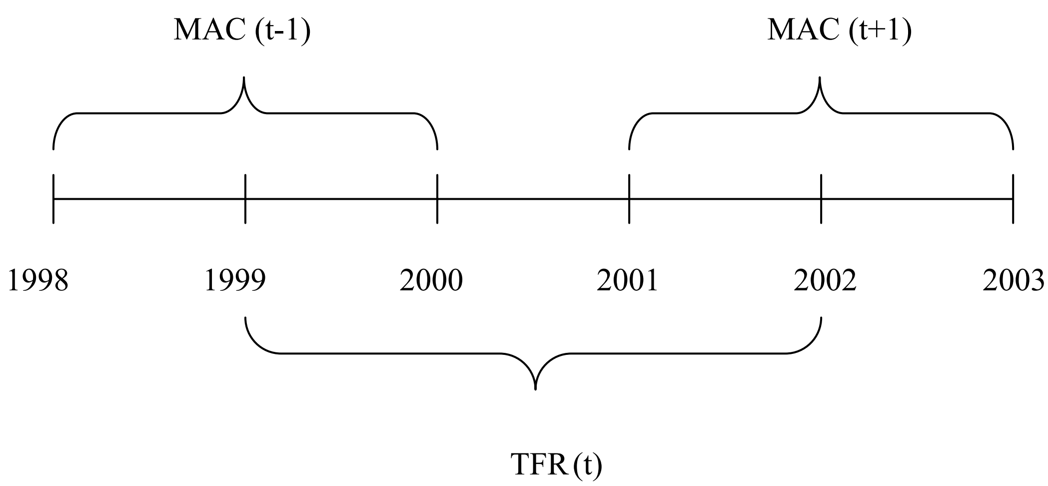



Imhoff and Keilman (2000) have also used this approach. However, Bongaarts and Feeney (2000) criticize Imhoff and Keilman (2000) in their article for using the formula $MAC_0(t) - MAC_0(t-1)$ to calculate $r_0$ for year $t$. Instead, they suggest the use of mean age at childbearing values that belong to the beginning and end of the period for which TFR is to be adjusted. However, since such data is usually not available, they suggest the practical use of the formula $(MAC_0(t+1) - MAC_0(t-1))/2$ to calculate $r_0$ for year $t$. Therefore, an additional approach that meets this requirement is also used, which will be explained in the next section.

### 2.4.3 An Alternative Use of Time Periods

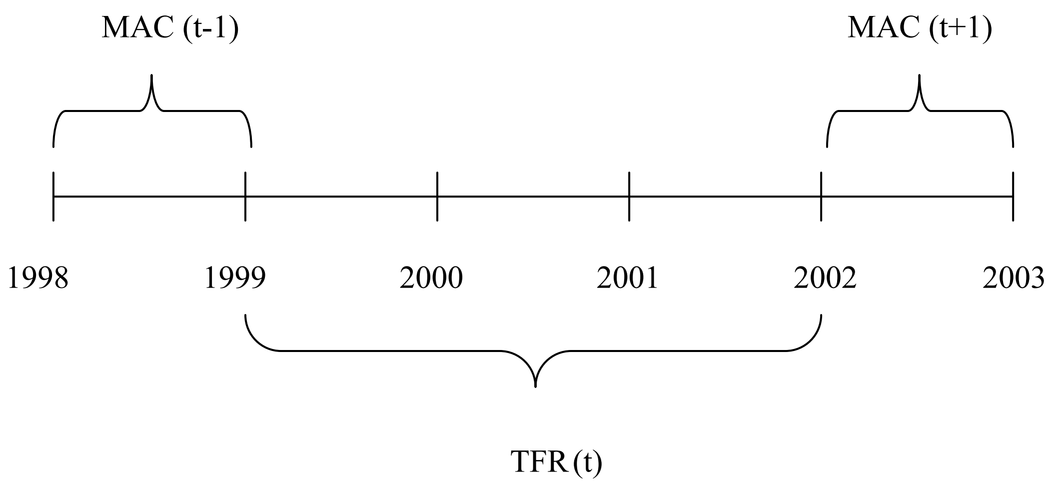
It is theoretically possible to calculate $r_0$ from both $(MAC_0(t+1) - MAC_0(t-1))/2$ and $(MAC_0(t+0.5) - MAC_0(t-0.5))/2$ (to obtain the exact period beginning and end values of mean age at childbearing) by using TDHS data. The below schemas explain this possibility by using the example of TDHS 2003. The first figure demonstrates $(MAC_0(t+0.5) - MAC_0(t-0.5))/2$, and the second one demonstrates $(MAC_0(t+1) - MAC_0(t-1))/2$.

**Figure 2.4.3.1** The Use of Time Periods for the Adjustment of TFR by Author, for 2003 TDHS




In this procedure, only the last five years of the birth histories are used in order to prevent the loss of the 15-19 age group. Therefore the last and first two years of the five year periods are used to calculate MAC, which give the midyear MAC values for 1999 and 2002, the years between which TFR is to be calculated and adjusted according to the changes in these MACs. Such use of data is useful in a way that does not require more than one survey to adjust a TFR value. However, it does not allow the adjustment of widely accepted TFR values that can be found in the survey reports, it cannot use the year preceding the survey.

**Figure 2.4.3.2** The Use of Time Periods for the Adjustment of TFR by Author, for 2003 TDHS




In the above case, the midyear MAC values are obtained for the periods 1998-1999 and 2002-2003, which can be used as an approximation of the change in the mean age at childbearing between 1999 and 2002.

## 2.5. VARIABLES

Calculation of tempo effects will be applied to several variables as well as to all women. The aim of applying the adjustment on variables is to see whether the categories of certain variables show differences in their contribution to the overall tempo effect.

The available data source, literature on tempo effects and the theoretical framework of the thesis are taken into account in the selection of variables. These variables are considered to be some of the variables that are associated with fertility timing. The application is not possible for all variables of interest, especially for those with too many categories. This problem arises from the fact that survey data is used, and computations lose their reliability if number of cases becomes insufficient for the calculation of TFR and mean age at childbearing, increasing standard errors. Another criterion that is taken into account in the selection of the variables is that they should be common to the three TDHS. Analysis is not possible for variables that do not exist in all three surveys.

Another important point is that, as mentioned in section 2.1.1.2, since the 1993 TDHS does not have a never married women's questionnaire or a separate module on never married women, a factor is needed to inflate the number of women in the ever married women's questionnaire to the number of all women of 15-49. In terms of variables, the calculation of this factor is only possible when the variable of interest may be obtained from the household questionnaire for all members. For some variables, it may be possible to use the all women factor of a different variable as an approximation. Resulting from the criteria above, the adjustments are performed on five basic chosen variables.

Three of the chosen variables (type of place of residence, region and education) are found as basic variables in the TDHS reports. Fertility shows significant variations over these variables according to TDHS (HUIPS; 1994, 1999 and 2004), therefore these variables may be expected to show differences in the timing of childbearing as well, since fertility begins earlier where it is higher, resulting in lower birth order specific mean ages at childbearing. Whether these mean ages are higher or lower may be associated with the extent of change in the timing of childbearing. The migration variable is included with an expectation that moving from one type of place of residence to another, or being geographically stationary may affect the timing of births. It is known from previous studies that (Hancıoğlu and Koç, 1999) ethnicity is an important determinant of demographic behaviour in Turkey. Thus mother tongue is included as a proxy determinant of ethnicity.

The type of place of residence variable describes residences in terms of urban or rural. Urban areas are defined as those having populations larger than 10,000 according to TDHS. This variable defines the type of place of residence according to this definition.

The region variable defines the de jure place of residence of women according to the five main regions of Turkey: West, south, central, north and east. This variable divides Turkey into five separate regions that have different socio-economic and demographic characteristics, and it is used frequently in social research (TDHS, 2003). The West region is known to be the most populous, industrialized and socio-economically developed among all (TDHS, 2003), and the East region is considered the opposite.

Migration status of women is considered as a variable of four categories: Urban native, rural native, rural to urban migrant and urban to rural migrant. This variable is computed by using two other variables: De jure type of place of residence and childhood type of place of residence. Childhood type of place of residence shows the type of place of residence a women has lived for most of the time until the age of 12. If both childhood type of place of residence and de jure type of place of residence are urban, then the case is considered to be urban native, and the same applies for rural. If childhood type of place of residence if rural, and de jure type of place of residence is urban, the case is taken as rural to urban migrant, and the opposite applies for urban to rural migrant.

This migration variable has certain assumptions and limitations. First of all, this approach does not take into account any migration movements taking place between the childhood place of residence and de jure place of residence. Secondly, women whose childhood types of place of residence or de jure places of residence are “abroad” are excluded from analysis, although the percent of which are found to be very low. Additionally, there are some cases which define their childhood place of residences as residence x, however, they have migrated from this residence x before the age of 6, which is contradictory to the definition of the variable childhood type of place of residence. This is seen in a very limited number of cases.

The education variable has three categories which are: No education/primary incomplete, first level primary, second level primary or higher. Eight years of education became compulsory in 1997, so these categories are applicable for 2003 only. For 1998 and 1993, first level primary refers to primary school in the previous system. Second level primary school refers to secondary school in the previous system. Educational attainment categories are more than three, the variable is recoded to give the categories listed above.

The last variable is mother tongue, for which the most frequent response is Turkish, followed by Kurdish and its dialects. Calculations will be carried out for these two categories only, since the rest of the responses are obtained from a very small number of women, which makes it problematic to perform computations on.

As mentioned above in section 2.1.1.2, a factor is used to inflate the number of ever-married women to all women for the calculation of TFR. For variables, this factor is available for the urban and rural types of place of residence, five regions and education. However, calculation of such a factor is not possible for the migration variable mentioned above, since this variable does not exist in the members of household data set. Thus the all women factor for correcting urban and rural types of residence is used as an approximation. This problem additionally arises in the mother tongue variable. The factor for five regions is used for this variable again for an approximation, as used before in a study by Hancıoğlu and Koç (1999).

## 2.6 LIMITATIONS OF THE THESIS

This thesis has its limitations on various subjects. One of them is the lack of available studies on tempo distortions in Turkey. Although there are many studies on this subject for the developed world, literature for developing countries is barely available and those that exist will be discussed in Chapter IV. The existence of more studies would have made the application process easier in addition to allowing comparisons from the results obtained. Moreover, discussions would be available in terms of fertility timing and period fertility in developing countries, which would help in basing the subject on stronger theoretical basis.

Another problem is the lack of vital registration system data. As will be mentioned in detail in Chapter IV, the adjustment is generally used on such data. However, this data source is not available in Turkey to allow the required computations, therefore survey data is used. The problems with survey data in terms of number of cases is mentioned in the previous section. Especially for TFR calculations involving variables, number of births decrease to very small numbers in higher birth orders. If registration data were available, calculations for ASFRs would be possible for single ages instead of five-year age groups, and TFR calculations and adjustments would be possible for single years, instead of longer periods of time. This difference in data sources is also a problem for making comparisons with other results obtained from previous studies.

As seen in section 2.4, should the time periods suggested by Bongaarts (1999) be used, it is not possible to obtain TFR adjustments for all three surveys all at once. If the TFR of one period is adjusted by using the MAC for the following period as by Bongaarts (1999), it is not possible to obtain an up-to-date adjusted TFR value, 2003 is left out. If the application is made as by Lesthaeghe and Willems (1993), then 1993 is left out. A demonstration of the approach in Chapter 2.4.3 can be found in the appendix.

One final limitation is that adjustments cannot be applied to any variable that exists in survey data, due to potential problems with number of cases. To avoid such problems, the adjustments are carried out on selected variables with limited categories only.

# CHAPTER III
# THEORETICAL FRAMEWORK AND FERTILITY OVERVIEW IN TURKEY

As mentioned before, changes in the level of period fertility are associated with both tempo and quantum of fertility. Changes in the quantum of fertility may be explained by the theories of fertility decline. Tempo changes in the forms of postponement of childbearing may be supported similarly, many theories that involve fertility decline include components that may explain a rising mean age at childbearing.

This chapter will begin with a short section on the well-known demographic transition theory, and continue with main theories of fertility decline. Following these, the second demographic transition theory will be mentioned, and finally, a fertility overview of Turkey will be given.

## 3.1 THEORETICAL FRAMEWORK

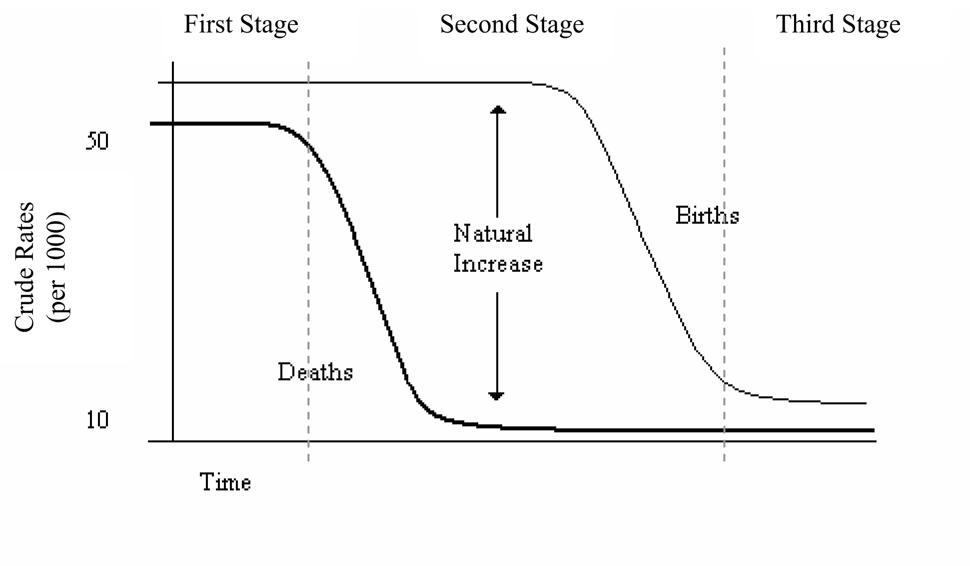
### 3.1.1. The Demographic Transition Theory

The demographic transition theory assumes a number of demographic stages defined by the changes in birth and death rates, that all societies are expected to go through.

The demographic transition theory was developed in the 20th century. Its development is generally associated with three demographers: Warren Thompson, Adolphe Landry, and Frank Notestein. Thompson’s first work on the issue was published in 1929, in which he had classified countries into three groups according to their birth and death rates. His work included forecasts regarding the groups of countries, and a prevision that some classes will follow the demographic trends of others. Landry (1934) has proposed three stages of population development in his work: Primitive, intermediate and contemporary. He has mentioned a demographic “revolution”, which he predicted would spread to the whole world. Notestein’s (1953) work however, is generally accepted to have led the development of the “classical” demographic transition theory. His work has provided the basis for the model explained below.

The demographic transition is usually accepted to be composed of three main stages (Definitions of four and five stages also exist in the literature.): A first stage where there are high birth and death rates, a second stage where a decline in death rates is expected followed by a decline in birth rates, and a last stage during which birth and death rates come close and population growth stabilizes. Population growth rate reaches its peak during the period between the initiation of mortality decline and fertility decline, as shown in Figure 3.1.1.1 below.

**Figure 3.1.1.1** A simple diagram of demographic transition




The theory is generally considered to be related to modernization. With modernization comes industrialization and urbanization, concepts that are known to be strongly related to decreases in birth and death rates. The first stage of the transition is marked with high mortality and high fertility, an expected situation in less developed societies. With certain developments, mortality decline is initiated in the second stage. Kirk (1996) has listed three main causes of mortality decline in the modern world the stages of which are briefly: (1) The establishment of public order, (2) Revolution in medicine, (3) The discovery of antibiotics. The first point includes issues such as the decrease of deaths due to wars, improvement of nutrition with developing agriculture due to stability and improved conditions of hygiene. The second point focuses on the discoveries of scientists such as Pasteur and Koch that have helped decrease infant and child mortality in particular, which have relatively high shares in less developed societies. The last one is similar to the second one, the discovery of penicillin by Fleming has led to the wide spread use of antibiotics, which resulted in lower mortality levels.

Kirk (1996) suggests that mortality transition is easier to explain than fertility transition. While the reasons of mortality decline are easily explained with physical factors, being a matter of choice, fertility decline cannot be handled in a straight forward fashion. De Brujin (1999) states that fertility decline within the demographic transition depends to a large extent on the collapse of economic, ideational and normative systems that support high fertility. The theories attempting to explain fertility decline will be mentioned in the next chapter.

After the beginning of fertility decline, the third and last stage is reached in the transition, where low levels of mortality and fertility are achieved, and population growth converges to 0.

There are certain limitations to the demographic transition theory suggested by some demographers. Coale and Watkins (1986) have carried out a study of Europe to find out the variables responsible for the onset of fertility decline, however, they have failed to relate the decline with socio-economic indicators of modernization. It was seen that different countries with very different socio-economic indicators could simultaneously enter a stage of fertility decline. Thus, the timing the theory assumes does not happen in a standard manner. The assumed relationship between modernization and fertility may not always be working in the sense of the demographic transition theory.

Additionally, de Brujin (1999) mentions a criticism that mortality decline does not always precede fertility decline as defined in demographic transition theory. Although it is an issue of debate, France is said to be a typical example of such behaviour.

Furthermore, examples of developing countries exist, namely China and Sri Lanka, with near replacement level fertilities that do not meet the “assumed requirements of socio-economic development” (De Brujin, 1999). Such empirical observations point out that the experience of the more developed and less developed are not identical, this is one of the criticisms to the theory: It is based on the experience of Europe, less developed countries in fact may experience a different interplay of demographic transition and modernization.

Another criticism the theory receives is that it excludes a “culture” dimension. Many demographers have carried out studies to support a relationship between culture and fertility decline. There are other limitations of the demographic transition theory claimed by demographers in addition to the major ones mentioned above, the details of which are beyond the scope of this thesis.

### 3.1.2. Theories of Fertility Decline

#### 3.1.2.1. Economic Theory

Economic theory of fertility explains the initiation of fertility decline from a micro-economic perspective. One of the main differences it holds against the classical demographic transition theory is that high fertility is said to have a rationale behind it, it is not an irrational decision of pre-modern societies. The demographic transition theory does not explain the high fertility in its first stage, it is given in every pre-modern society, however, economic theory rationalizes it by giving its economic benefits.

According to the economic theory, as the cost of children increases within modernization process, the decision of individuals for having children change, they choose to have less children due to economic factors. Kirk (1996) mentions that the early form of the theory has a mechanical perspective, taking children as one-dimensional, in terms of economic costs only. In the later form of the theory, quality of children is also included and the cost of children expands to include the opportunity costs of childbearing for women, mostly in terms of time. Women's enrollment in education increase and opportunity costs for childbearing increase, thus leading to postponement of marriage and parenthood and lower fertility (Lesthaeghe and Willems, 1999). This view is parallel with Becker's (1981) theory of increased female autonomy, where rising female schooling and employment are the major components.

Although economic theory has been a milestone in understanding fertility decline, it has been criticized for not taking cultural and social determinants into account. De Brujin (1999) comments that the economic approach "is incomplete in the sense that it discards the context in which decision-makers operate", unless the context is expressed economically.

#### 3.1.2.2. Wealth Flows Theory

The wealth flows theory is developed by Caldwell (1976) as an attempt to unify economic, cultural and institutional theories of fertility decline. It agrees with economic theory that high fertility at the beginning of transition is rational, however, the rationality defined by Caldwell is in a way different. He suggests that all societies are economically rational, what makes their behaviour different is their social context.

In the wealth flows view, the key issue is the direction of intergenerational wealth flow. In traditional or agricultural societies, children provide economic benefits to their families, thus creating a flow from children to older members of the family. With modernization come urbanization and nuclear families, and the cost of children increase, thus the flow changes direction, flowing from parents to children. Kirk (1996) suggests that being childless is most rational under these circumstances, however couples continue having children due to social and psychological reasons, though less than they did before.

Another important view Caldwell has brought is the distinction he made between the two concepts “modernization” and “Westernization”. Modernization is a structural change, Westernization on the other hand, is cultural, a “copying” as Kirk (1996) puts it. Caldwell shows that modernization in terms of economy does not have a strong relationship between the onset of fertility decline in the modern world. However, Westernization seems to have a stronger influence on fertility, the empirical evidence of which is shown as less developed countries with low levels of modernization and fertility.

#### 3.1.2.3. Easterlin’s Framework

Easterlin (1978) too has made efforts to combine economic and social theories of fertility decline. According to this framework, all determinants of fertility work through supply for children, demand for children and the costs of fertility regulation. Here, “demand for children” includes the socio-economic determinants such as income and costs/benefits of children, and is measured by desired family size. “Supply for children” includes cultural determinants such as exposure to sexual intercourse and sterility, and is measured by natural fertility (fertility in the absence of deliberate birth control) and “cost” is defined by physical constraints in the use of birth control, such as access to contraception or money required to obtain it.

According to Easterlin, individuals are motivated to limit fertility only if the supply of children is larger than the demand for children. The motivation gets stronger as the difference between supply and demand grows. This framework does not build any priorities or dominances between economic, social or cultural determinants.

Additionally, according to Easterlin's theory of relative economic deprivation (Easterlin, 1976, cited in Lesthaeghe and Willems, 1999), consumption aspirations of individuals rise. These aspirations are better fulfilled in dual-earner families, thus increasing female labour force participation, which leads to lower and later fertility.

### 3.1.2.4. Cultural and Ideational Theory

Culture is usually claimed to stand for the shared and intergeneration ally transmitted beliefs and evaluations about the world and people's place in it (de Brujin, 1999). Culture is thought to act on fertility by means of transferring values and interpretations within a culturally identifiable group (Lesthaeghe, 1977, cited in de Brujin, 1999). In empirical studies, culture is usually represented by variables such as ethnicity, language or geographical region (de Brujin, 1999). Turkish Demographic and Health Surveys allow the use of similar variables. Among the variables described in Chapter 2.5, region and mother tongue are related to this theory.

Caldwell (1982) has studied cultural theories introducing an anthropological perspective to demography. According to Fricke (1997) "demographers' appeal to the culture concept without attention to its uses in anthropology often causes either confusion or misapplication". Cultural and ideational theory is based on the idea that socio-economic factors alone cannot explain fertility decline. Clealand and Wilson (1987) argue that "the central assumption of all economic theories does not provide a plausible explanation of fertility trends during the last 100 years". Lesthaeghe (1983) underlines in his work that a "cost-benefit paradigm is necessary, but not sufficient." According to this theory, the fall from natural to controlled fertility is not completely due to cost of children, but is also owed to a shift in the ideational system.

The theory explains the shift with increasing individualism and shifts from community wants to individual wants. The empirical basis of the theory is from Europe. Lesthaeghe has focused on religious behaviour such as church attendance for instance to show the relaxation of religious control, and related them to changing values. Lesthaeghe's work will be covered in more detailed in section 3.1.3.

### 3.1.2.5. Diffusion Theory

Diffusion can be understood as the process by which innovations spread from one locale, social group or individual to another (Retherford and Palmore, 1983, cited in de Brujin, 1999). Diffusion allows ideas, techniques and behaviours through different media, and is gaining importance in a world of technology. Kirk (1996) claims that it would be almost impossible to explain the rapidity and pervasiveness of fertility declines in the absence of diffusion.

The widespread use of family planning is also very difficult to explain without diffusion. Groups of similar culture or language are affected by their interactions, and thus decisions form not from individuals only, but rather by a group of people in close networks. As Carlson (1966) states "Birth control behaviour is contagious and the fertility behavior of a population is not the simple aggregate of isolated individual decisions, but the end product of complex social interactions", control of fertility becomes a group decision.

### 3.1.2.6. Institutional Theories

Institutional theory considers the processes by which structures, including schemas, rules, norms, and routines, become established as authoritative guidelines for social behavior (Scott, 2004). The theory hypothesizes that the timing and pace of the fertility transition correspond with changes in socio-political institutions (Das Gupta, 1997).

According to Das Gupta's (1997) hypothesis, critical changes in reproductive motivations are shaped by changes in socio-political institutions and forms of governance which have gradually spread across the world over the past two centuries. With the changes in such institutions, people have become more socio-economically mobile, and have gained greater responsibilities on their individual decisions. Thus the ability of individuals to shape their own lives changed, including their reproductive lives (Das Gupta, 1997).

Institutional theory rejects economic theory, and suggests both socio-economic developments and fertility change may be resulting from same institutional changes. Therefore, according to the theory, the two phenomena are not sequential, but associated. The theory additionally related to the concepts "Westernization" and "Modernization", however, it is different in the way that it relates cognitive and institutional change.

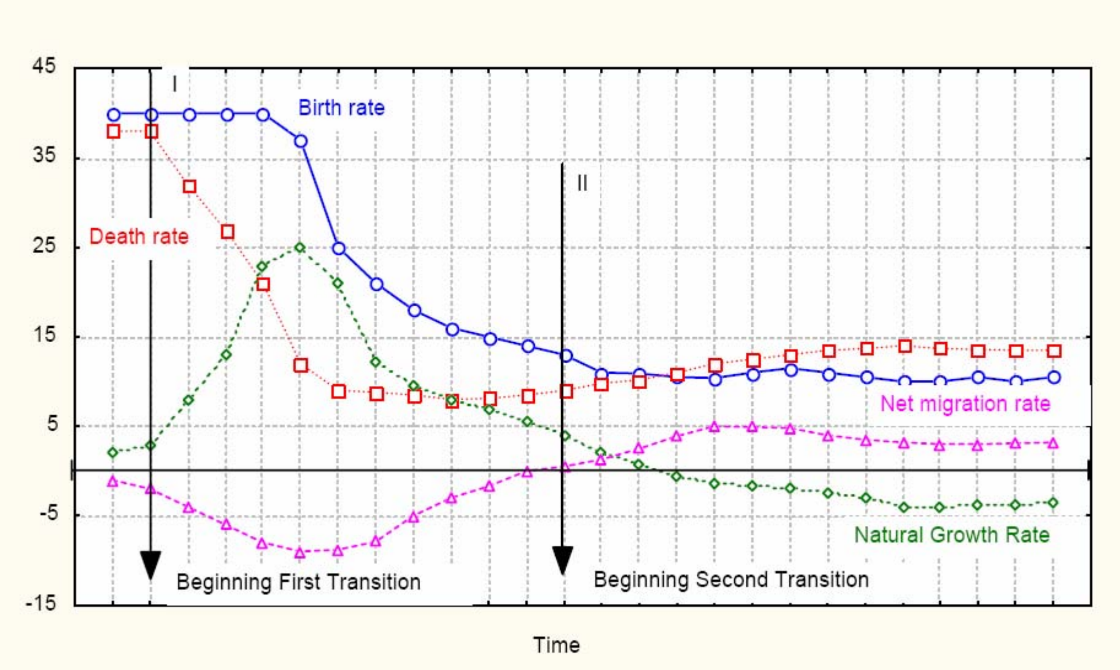
### 3.1.3 The Second Demographic Transition Theory

The idea of a second demographic transition was first suggested by Lesthaeghe and van de Kaa (1986). The theory takes its roots from demographic and social changes that took place in the mid 1960s in Europe. It was widely observed in Europe that after the completion of the first demographic transition, fertility rates did not remain at replacement level as predicted according to the transition theory, they continued to decrease. This decrease towards under replacement fertility is suggested to be a part of another transition, namely the second demographic transition. The perspective of this theory towards fertility decline is closest to that of cultural and ideational theory among above other theories.

The second demographic transition is mainly marked by low levels of fertility, changes in attitudes towards family, increasing cohabitation, divorce and separation, decreasing marriage, increasing share of extra-marital births, rising mean age at childbearing, and full control over fertility. Van de Kaa (2002) explains the change in attitudes towards family by mentioning a transformation from a “bourgeois family model” to an “individualistic family model”, and he adds that the days of the “child-king” come to an end within this change. This transformation leads to changes in family formation, including the dissolution of unions (Lesthaeghe and van de Kaa, 1986). Ariès (1980, cited in van de Kaa, 2002) emphasizes that the child is not absent from new family plans, however, “he fits into them as one of the various components that make it possible for adults to blossom as individuals”. The increasing importance of individualism thus allows individuals to focus on their personal choices more intensely. Women’s choices are especially of importance. By the end of their reproductive ages, women on average reach a completed fertility that is under-replacement level. In addition to this quantum effect, women also postpone their childbearing to older ages, there is also tempo effect. Van de Kaa (2002) points out that some of this postponement pushes a part of childbearing outside reproductive period.

In addition to fertility, the two other components of demography, mortality and migration, are also mentioned in the second demographic transition, although not as emphasized as fertility. Adult mortality increases within the transition, due to increasing proportion of elderly. High life expectancies at birth are expected for both sexes. As for migration, van de Kaa (2002) suggests a positive net migration rate.

**Figure 3.1.3.1**. A model of First and Second Demographic Transitions




*Source: Van de Kaa (2002)*

Figure 3.1.3.1 shows a model of a population that has gone through both classical and second demographic transitions. The feature to note in this figure is the display of trends in net migration. It is a model of a European population: The negative net migration during the first transition corresponds to migration movements from Europe in the 19th and 20th centuries to 'new worlds", Northern America and Oceania mostly. The positive net migration during the second transition is largely due to recruitment of guest workers, an action taken by many European countries after the Second World War. Guest workers mostly stayed however, instead of remaining as guests, and their families followed, which created a flow of migrants.

Birth and death rates follow the same pattern as described in section 3.1.1 for the first transition. Increasing death rates in the second, as mentioned before, are owed to the growing share of elderly in the population. Birth rates fall below replacement level. During this transition, death rates exceed birth rates, resulting in negative natural growth rates.

Lesthaeghe and Willems (1999) mention three stages of the second demographic transition that are roughly distinguished. The first stage is characterizes by fertility decline – by a strong quantum effect. The highlight in the second stage is fertility postponement, taking its roots from gains in female education, female labour force participation and continuing ideational change, with increasing union instability. Tempo effect is of more importance in this stage. In the last stage, postponement is expected to stop, however, some of the fertility that is postponed is not to be recovered at older ages, thus quantum effect once becomes dominant.

There are criticisms against the second demographic transition as well. One of them is that there are countries that have completed their first transition, and are not showing the signs of the second. The universal applicability of the transition outside the European region remains to be seen (Atoh, Kandiyah and Ivanov, 2004). Atoh, Kandiyah and Ivanov (2004) state in their study including Japan, Hong Kong, Taiwan, Thailand and China that although fertility has fallen below replacement in these countries, it is hardly due to increasing cohabitation and extra-marital births, but rather due to postponement of marriage. Such example both questions universal applicability, and the explaining of post transition below replacement fertility.

Another interesting point is a recent claim that labour force participation of women is in fact positively correlated to fertility. Although once the opposite might have been the case, there is now evidence that the relationship may be more complicated (Rindfuss and Brewster, 2000). If such claim is true, it contradicts to the nature of the second demographic transition.

The second demographic transition is of major importance in studies of tempo effects on period fertility, since studies on tempo effects usually aim to understand lowest-low fertility, a term used to describe very low fertility under replacement level, usually for TFR values under 1.3. Such fertility is very common in Europe. The main perspective in these studies on Europe's fertility is that it is actually not as low as it seems, that shifts in the timing of childbearing have a lowering impact on TFR. Imhoff (2001) explains the importance of tempo effects in Europe in one of his studies as: "In the practice of European countries passing through the various stages of the Second Demographic Transition, quantum and tempo effects from a period and cohort perspective are interwoven in a subtle and complex way. As a result, a single measure can never produce the full story." (Imhoff, 2001).

## 3.2 THE DEMOGRAPHIC TRANSITION AND FERTILITY DECLINE IN TURKEY

### 3.2.1 The Demographic Transition in Turkey

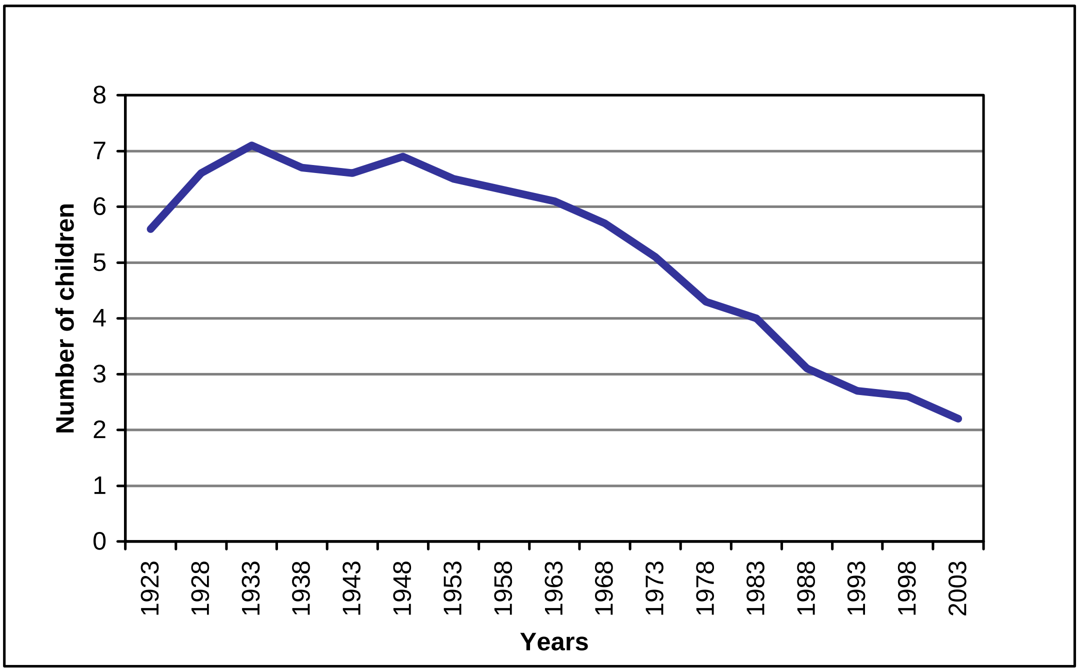
As mentioned in Chapter 3.1.1, the demographic transition theory itself is open to debate. Although there does not exist a perfect fit, it may be said that the theory applies to Turkey.

Turkey Statistical Institute (1995) has a publication in which there are claims to where the stages of the demographic transition fit to the history of the Turkish Republic. The approach in this publication assumes the foundation of the Republic as the beginning of the demographic transition, which may be found acceptable from certain point of views, and may be rejected by others.

Behar (1995) suggests that the fertility transition of some areas in Turkey began a long time before the foundation of the Turkish Republic in 1923. His study states that the TFR values of Istanbul were 3.5 and 3.8 respectively for 1885 and 1907, indicators obtained from Ottoman censuses. Such levels of fertility in Turkey as a whole were reached towards the end of the $20^{th}$ century. Similar findings suggest that transition was already underway in Istanbul in the $19^{th}$ century. Istanbul's crude birth rate on the other hand, was 29.4 and 18.7 respectively for 1907 and 1940s (Duben and Behar, 1991: Shorter and Macura, 1982, cited in Behar, 1995), which are again levels reached in Turkey after many years.

Thus, definite time periods for the stages of demographic transition do not exist. Additionally, the demographic behaviours of different areas in Turkey differ cross-sectionally. One region might have a fertility level close to replacement level, and another one may have twice of that. However, if the demographic behaviour of all areas in Turkey are assumed to be close to homogeneous, the approach of SIS' study (1995) may seem to apply well to Turkey. According to these classifications, the transition begins around the time of the foundation of the Republic, when there is very high mortality and high fertility. This stage is a post-war period. With war coming to an end, peace and recovery of normal life led to a steady decline in mortality rates (SIS, 1995). With the improvements in mortality, especially male adult mortality, an increase in fertility was observed.

**Figure 3.2.1.1** Changes in Total Fertility Rate, Turkey, 1923-2003



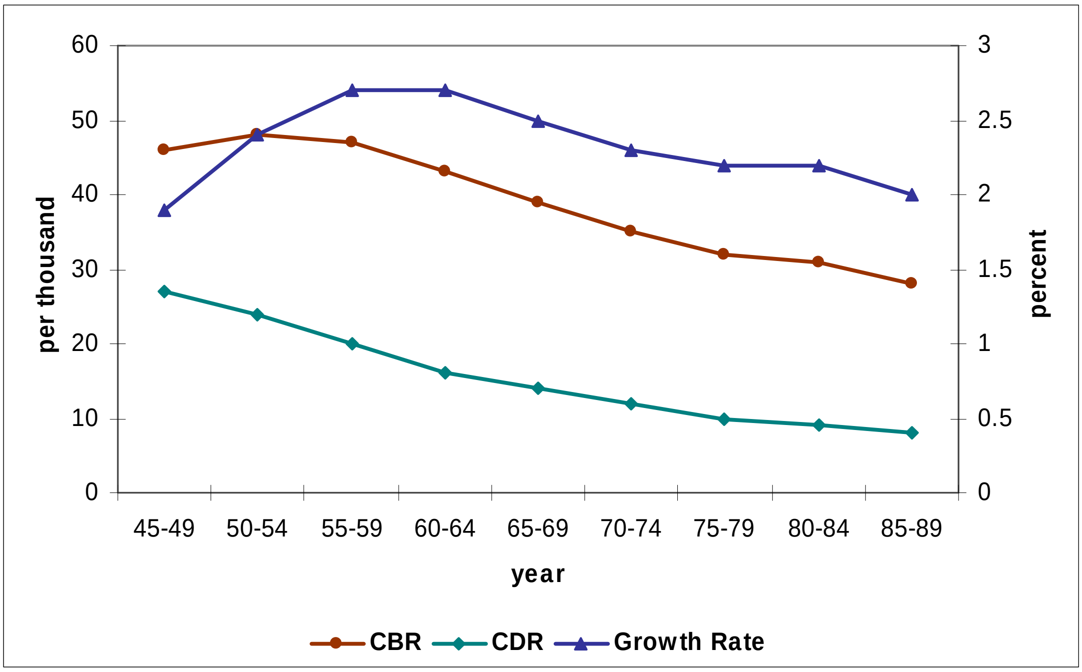

*Source: SIS (1995), HUIPS (1977; 1980; 1987; 1989; 1994; 1999; 2005)*

High fertility was also considered necessary for the good of the nation, since it was considered to be supportive for post war economic development, especially in terms of labour force. This increase in fertility came to a halt during 1950s (Figure

3.2.1.1). By this time, the supposed end of the first stage of transition, population growth rate reached its peak, and the population in 1923 had almost doubled by the mid 1950s.

The second stage begins with an irreversible fertility decline. Figure 3.2.1.1 shows both the beginning of birth rates and the continuing decline in death rates. Urbanization was a major development of this stage (SIS, 1995). Families moved from rural areas to industrializing urban areas with new job opportunities. Thus families chose to have less number of children. The end of this stage of the transition is not marked by a specific event. However, SIS (1995) defines the third stage of the transition to begin during the 1980s.

**Figure 3.2.1.2** Selected Demographic Indicators, Turkey, 1945-1990




*Source: Behar (1995)*

SIS (1995) explains the growth rate in the third stage to be definite and irreversible. To reach the end of the transition, birth and death rates should converge to give a population growth rate of nearly zero. SIS (1995) estimates this to happen in the mid 21$^{st}$ century.

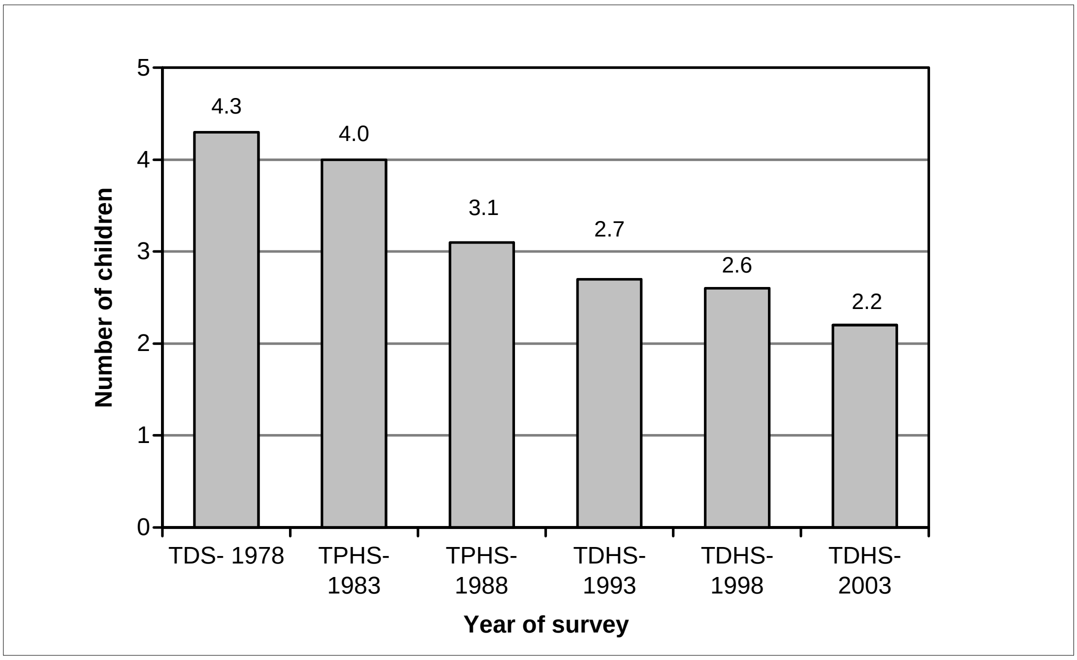
### 3.2.2 Fertility Decline in Turkey

Fertility decline is a known phenomenon in Turkey since the 19th century, as Behar (1993) mentions. Looking at the overall TFR value, it has been declining from a value close to 7.0 in 1950s to reach a level of 2.3 in 2003.

As mentioned in the previous section, government's view has been pronatalist from the foundation of the Republic, until the 1950s. High fertility was though to be related with a high rate of socio-economic development. Towards the 1960s, this view began to change, parallel to popular views around the world that a growing population was an obstacle on the way to development. However, TFR had already fallen below 6 in 1965 when the first antinatalist policy was introduced (Hancıoğlu, 1997). Thus, this policy was not very effective on fertility decline on its own, it was already underway. Another policy was introduced in 1983, the focus of which was mainly maternal and child health. Abortion became available on demand with the law of 1983, and all contraceptive methods had been legalized by this date.

Figure 3.2.2.1 shows the decreases in total fertility rates from the end of 1970s and on, calculated from quinquennial demographic surveys. The largest decrease is observed from 1983 to 1988, TFR has decreased by about 75%. It has fallen below 3 by the beginning of 1990s, and it has reached a level just above replacement level in 2003.

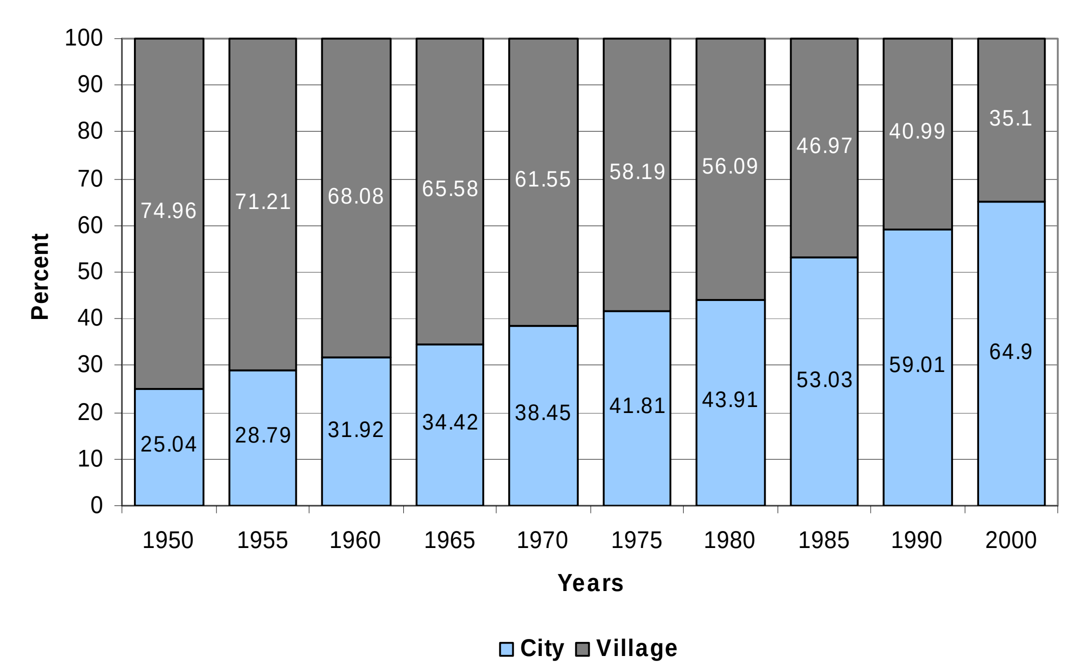
**Figure 3.2.2.1** Changes in Total Fertility Rate, 1978-2003




*Source: HUIPS (1980; 1987; 1989; 1994; 1999; 2005)*

Many determinants acted on fertility decline in Turkey, the whole of which are beyond the scope of this thesis. However, those that not only affect the level of fertility but also its timing will be discussed in descriptive terms. One of the factors that has been effective on fertility decline is urbanization, the changes in which are seen in Figure 3.2.2.2. Increasing urban percents can be associated with economic theories of fertility decline. With urban areas becoming more attractive to rural residents, families move from one to the other. The cost of children increases with this process, and wealth flows change direction. These lead to family limitation.

**Figure 3.2.2.2** The Changes in City and Village Percents, 1950-2000*

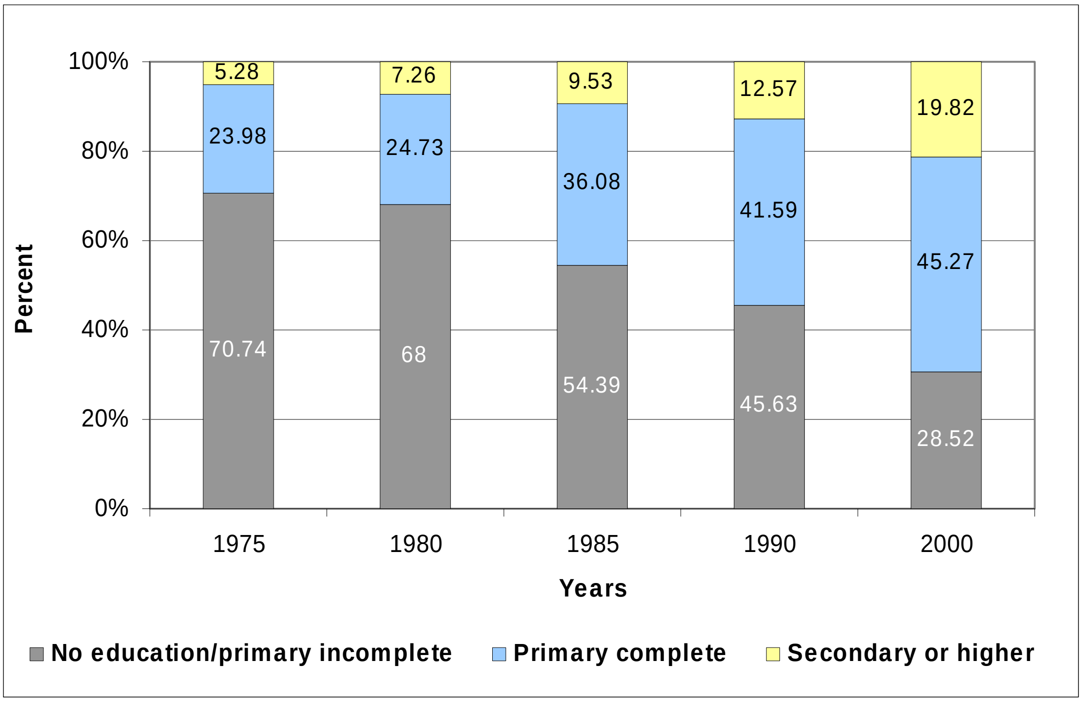



*Source: SIS (2003)*

**The definitions of SIS for city and village are based on administrative units. They are different from the rural and urban definitions of HUIPS, used in TDHSs.*

Another development is increasing female education (Figure 3.2.2.3). It is a well known relationship that fertility decreases with increasing education. One of the results of increasing female education is the lengthening time spent in education. Women may postpone marriage and thus marital fertility by spending more years in education. According to TDHS 2003, while women with no education or who have not completed primary school have a TFR of 3.65, women with education levels of high school or higher have a TFR of 1.39.

**Figure 3.2.2.3** Distribution of women over ages 25 and over with respect to education level 1975-2000

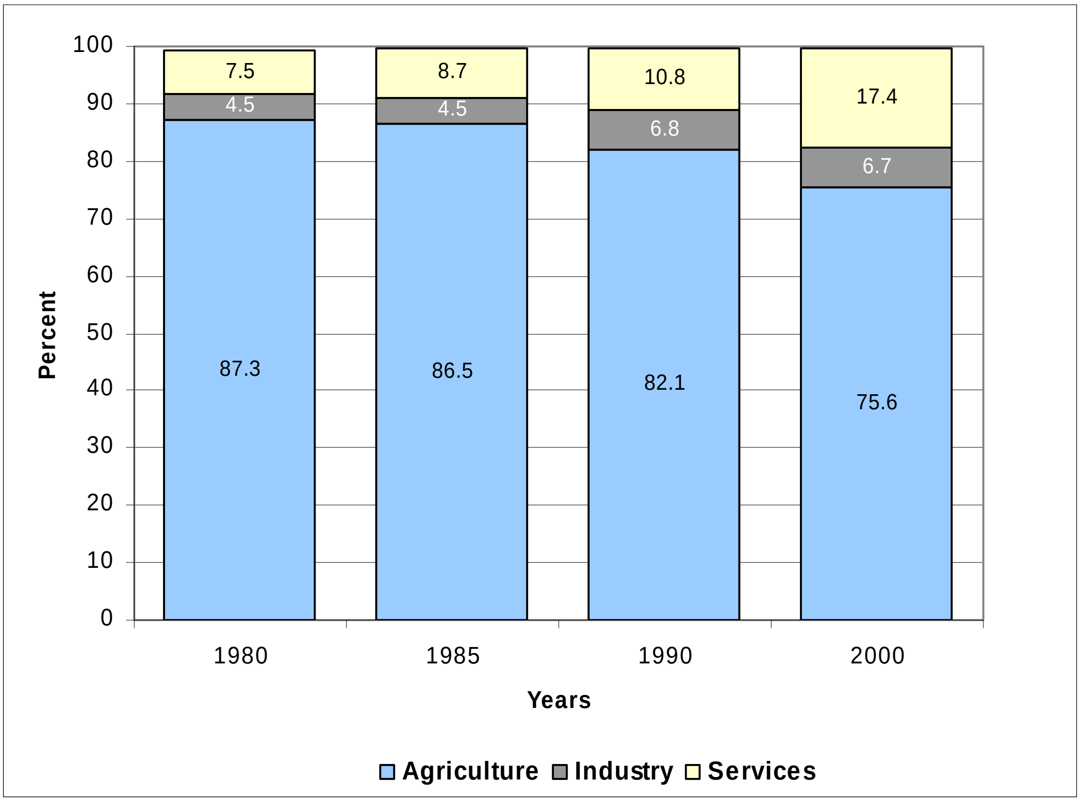



*Source: SIS (2003)*

As seen in Figure 3.2.2.3, the share of women that have not been enrolled in formal education, or have not completed it has decreased dramatically from over 70% to below 30%. In terms of postponement, the increase in the share of women having an education level of high school or higher is important, this share has reached a value of almost 20% in 2000. Although significant changes have occurred in terms of educational attainments of women, the share of those who have not received formal education or have not completed it show that there is a yet a large potential for change in these distributions if compared to those of developed countries. If postponement is assumed to be related to years spent in education, this also means there is more room for postponement.

Labour force participation of women is another important indicator in explaining fertility timing. As in developing countries, labour force participation of women is expected to follow a “U” shaped pattern (TÜSİAD, 1999). A very high participation is expected at the beginning, due to non-paid family work or agricultural labour. With urbanization, this participation decreases, and its distribution by economic activity changes. The share of women working in agriculture decrease, and they move to other sectors. As the shift from agriculture slows down, the overall participation of women begin to increase again. This “U” pattern is worthy to note, for Turkey may be approaching the second stage of the “U”. Data from censuses so far show the decreasing proportions. The labour force participation of women has been 45.8 in 1980, 43.6 in 1985, 42.8 in 1990, and has reached 39.6 in 2000 (SIS, 2000). Figure 3.2.2.4 shows the transformation of women from agricultural to other sectors.

**Figure 3.2.2.4** Women’s Employment by Economic Activity*

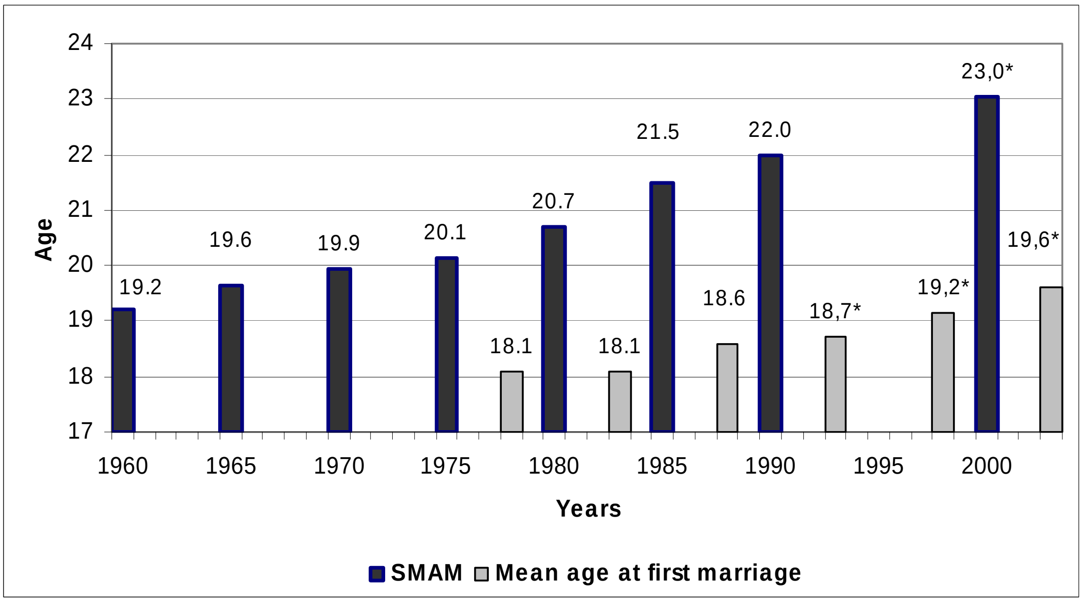



*Source: SIS (2003)*

** The share of the category “other” has been left out, since it is smaller than 1% in all four series and is too small to be spotted on the graph.*

The previously mentioned factors may additionally be associated with the timing of marriage, while the timing of marriage is related to the timing of first birth, since almost all births occur within marriage in Turkey. Behar (1995) mentions high mean ages at first marriage in the late 1930s in Istanbul, and he states that these changes in nuptiality rates are as responsible as decline in marital fertility in the fall of TFR. Figure 3.2.2.5 gives the estimates for mean age at first marriage from censuses, and mean ages at first marriage for women ages 25-40 from surveys. The mean age at first marriage has increases 1.5 years from 1978 to 2003 according to survey values, and 2.3 years from the 1980 census to 2000 census.

**Figure 3.2.2.5**. Mean Age at First Marriage and Singulate Mean Age at first Marriage, 1960-1990

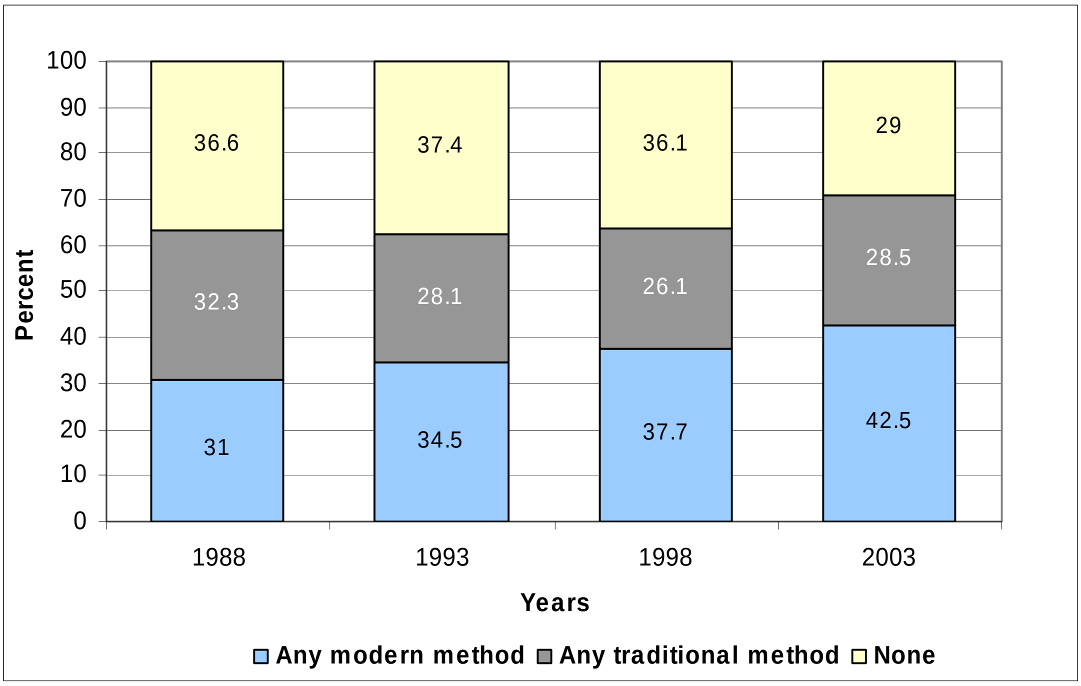



*Source: SIS (1995); HUIPS (1987; 1989)*

** Own calculations of author.*

An important demographic indicator that can be associated with both fertility decline and timing is the use of contraception. The spread of knowledge and use of modern contraception allows couples to decide the timing and the number of children they wish to have. This control over fertility affects marital fertility in terms of quantum and tempo. The figure below (Figure 3.2.2.6) shows that the share of modern method users increases with time, implying stronger control over fertility. The decrease in non-users is also worthy to note.

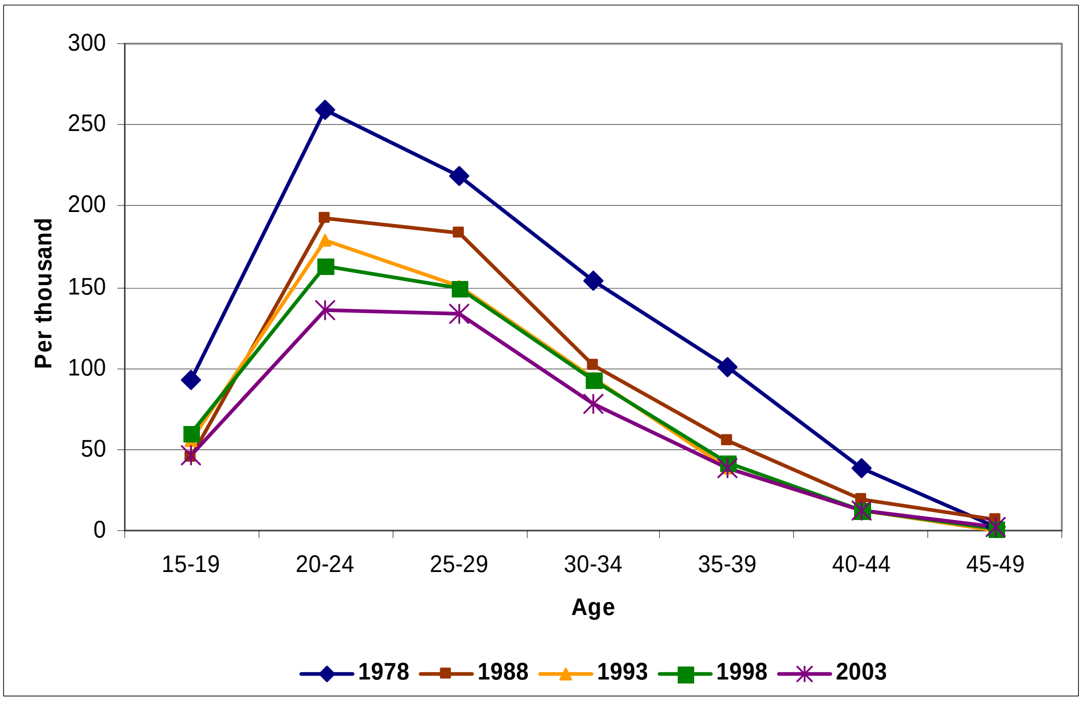
**Figure 3.2.2.6** Changes in Contraception Use, 1988-2003




*Source: HUIPS (2005)*

TFR has fallen below 3 in the late 1980s, and has reached 2.23 as of 2003. Not only has the level of fertility has changed, but also its pattern. As seen in Figure 3.2.2.7, the peak of the distribution is in the 20-24 age group in 1978. The decrease towards the other age groups is almost linear. In more recent distributions however, the peak is shared between 20-24 and 25-29 age groups, and the decrease towards later ages is curve-shaped, meaning a faster decrease is observed towards later ages.

**Figure 3.2.2.7** Age-Specific Fertility Rates, 1978-2003




*Source: HUIPS (2005)*

According to the figure above, the largest change in the level of fertility is between the years 1978 and 1988. Firstly, this interval is twice as long as the others. Secondly, this pattern was already observed in Figure 3.2.2.1, relatively smaller changes in TFR are observed for the more recent surveys. The changes in the distribution according to age groups is important for this thesis, the decreases in 15-19 and 20-24 age groups give clues of increasing ages at first birth for instance.

# CHAPTER IV
# LITERATURE REVIEW

## 4.1. BACKGROUND TO BONGAARTS AND FEENEY ADJUSTMENT

Hajnal (1947) is one of the first to focus on the importance of timing on childbearing. His work underlines that births of one year are affected by the births of the previous year. This claim can be supported even from a physiological point of view. Theoretically, if all women of childbearing ages have births in one year, due to postpartum conditions, the births of the following year would be very low. Thus, successive years are dependent on each other.

Hajnal additionally discusses that in modern times, couples not only plan the number of children they will have, but also the precise spacing of their births. Additionally, they may change the rate at which they have their children, but keep the number the same. An example is periods of war or economic depression: Couples may postpone having another child until conditions improve. Thus first a decrease, then an increase is observed in fertility rates. Hajnal additionally claims that family size actually remains fairly stable, and the fluctuations in fertility rates are mostly due to changes in timing of births.

The article by Hajnal (1947) includes a simple arithmetic procedure to demonstrate the effects of postponement on fertility rates. His theoretical example is as follows: Among three successive years, the second year has 90% of the birth rates of the first, and the third year has 80% of that due to a postponement. If the number of births of year three is $f'_n$, then the number of births are 1.125 $f'_n$ and 1.25 $f'_n$ for the second and first years respectively. Then the average number of children for couples married for n years is:

$$T'_n = 1.25\sum_{i=0}^{n-2} f'_i + 1.125 f'_{n-1} + f'_n$$

The first term in the right side of the equation is the sum of constant birth rates until postponement begins. The second term belongs to the first year of postponement, and the third term to the second year of postponement. The fertility rate at year n according to above equation is:

$$T'_n - T'_{n-1} = 1{,}25\sum_{i=0}^{n-2} f'_i + 1.125 f'_{n-1} + f'_n - \left[1.25\sum_{i=0}^{n-3} f'_i + 1.125 f'_{n-1} + f'_n\right] = f'_n + 0.125 f'_{n-2} + 0.125 f'_{n-1}$$

Thus the birth rates $f'_n$ can be modified by adding $0.125 f'_{n-2} + 0.125 f'_{n-1}$ to reach the level before postponement.

In addition to John Hajnal's contributions, many studies regarding tempo effects mention Ryder's work as theoretical background. In the late 1940s, Ryder began to work on period and cohort fertility rates. He has published a series of articles (1956, 1959, 1964, 1980, 1983) that are around this issue and include empirical applications. In his applications regarding the United States, it is possible to see the relationship with timing and number of births. In periods of postponement (1970s and 1980s), number of births per year have tended to decrease, and the opposite has happened in the opposite case (late 1940s and 1950s).

Ryder has shown that the two types of rates diverge in the long run even if fertility has been constant for a long period of time, and he has identified the source of these divergences. In this sense, he has attempted to relate cohort fertility measures to period fertility measures. He has stated that, under constant fertility, when cohort mean age at childbearing is on the rise, TFR tends to be lower than CFR. Although there are more than one, below is his well known "translation" formula with the assumption of linearity in time trends of the age-specific fertility rates:

$\mathrm{TFR} = \mathrm{CFR}\ (1 - r_c)$ where $r_c$ is the rate of change in cohort mean age at childbearing, and $(1 - r_c)$ is referred to as "index of fertility distortion".

Regarding the use of the formulas in analysis, Ryder has claimed that it was possible to determine the level of current fertility using his translation formulas. He has also suggested that it was possible to make inferences on cohort parameters with the translation formulas. It is stated that state that these translation formulas may be applied when fertility is changing slowly by comparing the TFR for any given year with the CFR for the cohort that reaches its mean age at childbearing in this year (Ryder 1956; Sobotka 2003, cited in Bongaarts and Feeney, 2005).

In addition to the studies mentioned above, Brass has calculated estimates of tempo-adjusted TFR for two European countries using data on marital fertility by parity and time elapsed since last birth (1991, cited in Sobotka, 2003). Murphy also proposed an adjustment of the TFR based on changes in the mean age at childbearing. This adjustment was an approximation of the Ryder's (1964) translation formula (1994, cited in Sobotka, 2003).

## 4.2. DISCUSSIONS AROUND THE BONGAARTS AND FEENEY ADJUSTMENT

Since Bongaarts and Feeney have proposed their adjustment method in 1998, it has been the centre of many discussions. Several articles criticizing it have been published, and replies have been given, and many other studies have mentioned the method other than these. This section will begin with summarizing the criticisms and will end with the replies to them.

The first criticisms were published in 2000, there were two of them discussing the Bongaarts and Feeney adjustment. One of them is by Kim and Schoen (2000).

It was claimed by Kim and Schoen in their article that the mathematical basis of the AdjTFR holds under very restrictive conditions. It is suggested in their study that, although Bongaarts and Feeney do not state it explicitly, their method requires another assumption, that the changes in the mean age at childbearing should be present for a long period of time. This condition is stated to be too unrealistic. It is additionally stated that AdjTFR holds only in the long run, only when all cohorts of childbearing age go through the same history of constant period shifts. Therefore AdjTFR becomes unstable when change in the mean age at childbearing varies over time. Another claim the authors make is that under constant period and cohort fertility, even modest changes in the timing of childbearing cause AdjTFR to fluctuate strikingly. This claim is supported with hypothetical examples. It is concluded that "the measure performs as claimed under the assumption of a constant linear shift affecting every cohort of reproductive age", and it performs poorly otherwise and that the measure "mischaracterizes the course of completed fertility".

Another comment paper was published by Imhoff and Keilman (2000). It is claimed in this study that the Bongaarts-Feeney adjustment was not capable of isolating pure quantum effects. This claim is based on two different points. First, it is suggested that cohort-specific changes in timing of childbearing were more complex than assumed by Bongaarts and Feeney. And second, the adjustment procedure is based on unsuitable measures, thus there is bias in AdjTFR.

The first point focuses on the "constant shape of fertility schedule" assumption of the Bongaarts and Feeney adjustment, it is claimed that this is not supported by data, and support their criticism on data from the Netherlands and Norway. The second point made by the authors is that the use of occurrence-exposure types of rates is more suitable than incidence rates for adjustment purposes, because otherwise the effect of tempo distortions is exaggerated. An example of this exaggeration is the case where $TFR_1$ exceeds 1. This is due to a methodological deficiency in the calculation of TFR. The Bongaarts and Feeney adjustment does not erase this methodological deficiency of the TFR. It is concluded that the Bongaarts and Feeney method "does not solve the tempo-distortion problem", and that there should be further work using more extensive data and new methodologies.

Imhoff (2001) has published another article titled "On the impossibility of inferring cohort fertility measures from period fertility measures" in the following year. In addition to previous attempts to relate cohort and period fertility measures, the author has commented on the Bongaarts and Feeney adjustment. It is referred to as another attempt to infer cohort fertility measures from period fertility measures with the claim that the authors contradict in the purpose of their method, and the following quotes are given from the original study of the authors to support this: "We are not attempting to predict cohort fertility, only to get an improved reading of period fertility", and "[adjusted total fertility rates] will do a better job of doing what conventional total fertility rates do poorly in the presence of tempo changes: reveal the level of completed fertility implied by current childbearing behavior". From the second quote, Imhoff concludes that the AdjTFR is actually an attempt to estimate completed fertility, and claims that this measure gives no information on cohort fertility if the relationship between the real and synthetic cohorts is unknown. He states that he agrees with Ryder (1964) in his quote "No cohort parameter can be computed accurately until that cohort has completed the activity being studied".

Imhoff also makes two other theoretical criticisms to the measure, which is similar to those mentioned in Imhoff and Keilman (2000). The first one is that cohorts behave according to past experience, so period effects act on different cohorts differently. The example of introduction of the pill is given: Its effect will be very different for women at the beginning and later stages of childbearing ages. Mentioning this point, the constant shape of fertility schedule assumption is criticized. The second criticism is to the use of birth frequencies, that the denominator is not made up of women by corresponding parity when ASFRs for birth orders are calculated. Imhoff states that tempo changes affect the denominator as well as the nominator, therefore the measures turn out to be less reliable and distortions tend to be higher. Kohler, Billagi and Ortega (2002, cited in Kohler and Ortega, 2002) explain this as "The order specific $TFR_i$s are frequently distorted by the parity composition of population and its changes over time". Imhoff includes that this does not mean the adjustment produces systematically biased results, but the ideal conditions for it to work well will be rare in real life.

Smallwood (2002, cited in Sobotka, 2003) has similar concerns regarding the Bongaarts and Feeney adjustment. He mentions the debate of whether the method is trying to approximate cohort fertility. According to him, “if the intention is to adjust period data to produce underlying cohort fertility the various proposed methods can be tested empirically.” However, if not, the author suggests more thoughts on what adjusted measures such as Bongaarts and Feeney’s are actually giving.

A study by Sobotka (2003) includes notes on inferring to cohort measures by period ones. The article compares several period fertility indicators to cohort fertility to see if there is any among them that is close to cohort fertility. Two major findings related to this issue are: (1) Some period indicators do come close to cohort fertility, especially during periods of intensive timing changes. (2) This pattern changes according to birth order. As for AdjTFR, the study concludes that it has an average extent of approximating cohort fertility.

A reply on the comment papers by Kim and Schoen (2000) and Imhoff and Keilman (2000) has been published by Bongaarts and Feeney (2000). It is underlined in this article that the adjustment method does not “attempt to estimate the completed fertility of any actual birth cohort or any prediction of future fertility”. Regarding the comment paper by Kim and Schoen, the authors suggest that their study has been misread, that the conclusions drawn are all based on the false assumption that the adjustment attempts to estimate the completed fertility of actual cohorts. The criticisms in this study are therefore said to be irrelevant.

As regards to the comment paper by Imhoff and Keilman, Bongaarts and Feeney argue that the use of occurrence-exposure rates is not necessary to make the method valid. Additionally, the authors object to the criticism that the invariant shape of fertility schedule assumption is “clearly violated”. It is suggested that the demonstration to support to criticism has technical problems (explained under “Notes” in Bongaarts and Feeney, 2000). However, more evidence is presented to support the critical assumption of the adjustment formula. It is stressed that the assumption does not hold exactly, but it is to approximate reality sufficiently. Thus the authors state that the problem is not whether the assumption is violated, but rather whether the violations are negligible or not. Examining examples, the authors once again conclude that their assumption generally gives a good approximation of reality, although it is also agreed by them that it would be useful to include variance effects as Kohler and Philipov (2000) have. It is added that a sensitivity analysis of the errors resulting from the assumption would prove useful at this point and a study made by Zeng and Land (2000) is mentioned, which will be explained in the following paragraphs. The authors conclude that their critical assumption generally introduces only small errors in the calculation of AdjTFR.

Zeng and Land (2000) have carried out a sensitivity analysis of the Bongaarts and Feeney Adjustment to check the method's underlying "constant shape" assumption and the implied assumption about equal changes in the timing of births of all reproductive ages. The study begins with a warning that if the method is sensitive to the violation of the assumption, then it should not be used without appropriate correction.

The study includes examples from USA and Taiwan, and Brass Relational Gompertz Fertility Model and its extension as the analytical method. A second AdjTFR is designed that takes variable shapes into account and is compared to the values of the original AdjTFR to see the differences. It is concluded that the original AdjTFR does not usually differ from the newly designed AdjTFR. Thus it is stated that the results of Bongaarts Feeney adjustment are generally not biased. Zeng and Land add that the use of parity specific birth probabilities would be more suitable than the use of frequencies.

Philipov and Kohler (2001) have both tested the assumptions of the Bongaarts and Feeney formula, and applied it in an article where they studied fertility decline in Eastern Europe. They suggest that AdjTFR can only be interpreted if the key assumption of the formula is empirically justified. They base their test of the assumption on the question whether changes in the shape of fertility schedule are significant or not. The authors add that Bongaarts and Feeney have not tested this question directly, but have rather compared the AdjTFR values to completed fertility values.

The methodology of testing the assumption in this study is briefly as follows: Both descriptives and statistical inference have been used. Two sets of fertility schedules are compared, those of year t and t+1, and those of year t and t-1. These schedules are observed. Standardized ones are also obtained to exclude shifts in mean age and fertility level. If the standardized schedules for two consecutive years are similar (although not exactly, the randomness of birth process may keep the two schedules from being exactly the same), this shows that the assumption holds. After applying these on a number of Eastern Europe countries, the authors state that the impact of variance on AdjTFR can be as large as 10% of the AdjTFR value, however it is usually around 3-5%. As for statistical inference, the null hypothesis that two consecutive schedules come from the same population is tested, and as a result, they fail to reject the null hypothesis. Survival analysis approach has also been used.

After applying these tests on empirical data, the authors have concluded that "there is no such effect (age-period effects on the values of AdjTFR) where *trends* described by the adjusted TFR are only used”. They comment in their conclusion on the AdjTFR value, suggesting the higher values obtained for period fertility in Eastern Europe will be helpful in correcting policies and decisions regarding demographic issues.

Lesthaeghe and Willems (1999) apply the Bongaarts and Feeney adjustment in one of their articles. This paper has a focus on low fertility in Europe, and it aims to discuss whether these low levels will recover in the future. As will be mentioned in section 4.3.2, the authors first have applied the method on several countries, then have made population projections for these countries to discuss future trends. They have a concluding remark on the application of Bongaarts and Feeney equation, suggesting that it is not recommended to be used as a prospective tool unless used with caution. They underline that the resulting level from the adjustment is not necessarily the future level of fertility TFR will recover to. One argument supporting this view, is that postponements in childbearing not only cause tempo effects, but also tempo effects. Kohler et al. (2001, cited in Goldstein, Lutz, Scherbov, 2003) have estimated that an increase in one year in the mean age at birth lowers cohort fertility by about three percent. This estimation clarifies that a full recovery of TFR to the level of AdjTFR is not possible.

## 4.3. APPLICATIONS OF THE BONGAARTS AND FEENEY ADJUSTMENT

### 4.3.1. Applications on Developing Countries

The applications of the Bongaarts and Feeney adjustment on developing countries are very limited. Tempo effects are usually considered to be of importance in Europe. This is because period fertility rates are found to be very low, it is of the interest of policy-makers to know the underlying reasons, and tempo effects are technical reasons for low period fertility. However, Bongaarts (1999) has focused on tempo effects in developing countries and Population Reference Bureau (2006) has calculated some values of tempo effects for European countries including Turkey.

Bongaarts (1999) has focused on this issue and stated in his study that "Tempo effects are usually ignored in the analysis of fertility trends in developing countries even though in theory there is no reason to expect them to be limited to the developed world."

Bongaarts' (1999) work calculates tempo effects on Taiwan, an exceptional example of a developing country with a reliable registration system. It additionally includes Colombia, the data of which is obtained from four successive World Health Surveys and Demographic and Health Surveys. A final section is on other developing countries for which two successive surveys are or one survey is available. For those countries with only one survey available, Bongaarts has examined two main indicators, TFR of the first birth and trend in median age at first birth. The level of the TFR of first birth is a good indicator of possible tempo effects, since normally a value close to 1 is expected in developing countries. The trend in the median age at first birth is a suitable measure since mean age at childbearing may not reflect real postponements or advances, as mentioned in section 2.2.

This study includes Turkey within the countries with one or two successive surveys available, therefore no tempo effects are calculated for Turkey. The TPHS of 1988 and the TDHS of 1993 were used, and Bongaarts calculated a $TFR_1$ of 0.74 for Turkey from the 1993 TDHS and an annual change of 0.22 in the median age at first birth, suggesting a postponement in births.

The example of a country with a series of surveys available is Colombia in this study. Bongaarts (1999) has used four surveys, dated 1976, 1986, 1990 and 1995. The application procedure is as explained in Chapter 2.4.1.For the 1986 survey, $TFR_1$ raises from 0.77 to 0.93 after adjustment. The overall TFR is 3.34 for the same survey, and its AdjTFR value is 4.07, giving a tempo effect of about -0.7.

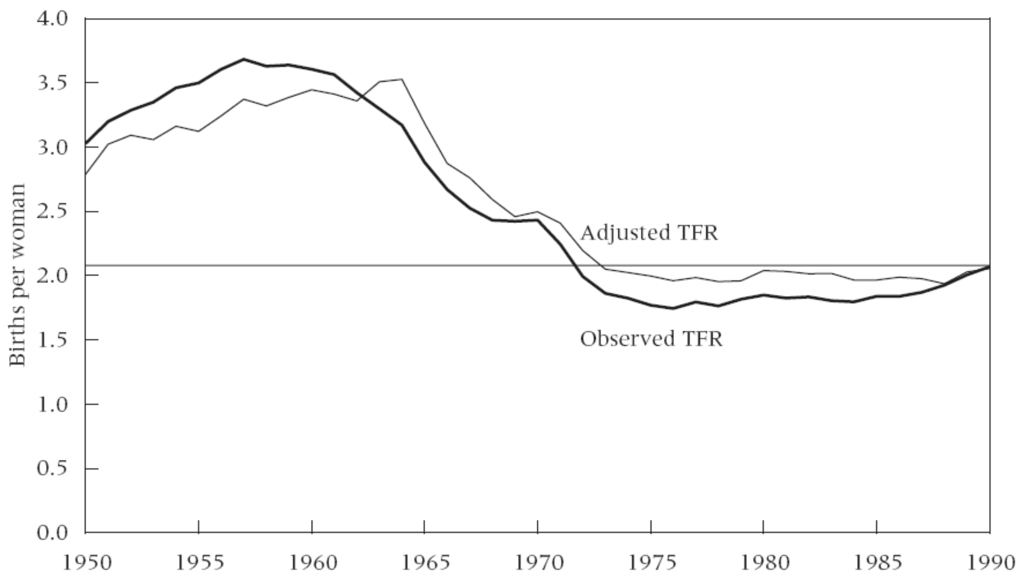
European Demographic Data Sheet 2006 (Vienna Institute of Demography, International Institute for Applied Systems Analysis and Population Reference Bureau, 2006) includes many demographic indicators for European countries. Turkey is included in the list, and a TFR and adjusted TFR value for 2004 is given for Turkey. The values are 2.41 and 2.44 respectively. The methodology for this calculation is developed by Philipov and Sobotka (2006), mentioned in Chapter 2.

### 4.3.2 Applications on Developed Countries

As mentioned in Section 4.3.1, there are many examples of the application of the Bongaarts and Feeney Adjustment on developed countries, especially Europe. This section reviews these studies.

Bongaarts and Feeney (1998) have applied the adjustment to two different countries in their article in which they have suggested the adjustment formula. One of the applications is on USA, and the other one is on Taiwan. Data for a long period is available for USA, adjustments were possible for the period 1950-1990, the graph of which is given below:

**Figure 4.3.2.1** Observed and Adjusted Total Fertility Rates for the United States




*Source: Bongaarts and Feeney (1998)*

The graph above shows a decrease in the mean age at childbearing during the post Second World War baby boom, the adjTFR values are lower than TFR values during this period. The opposite is observed after mid 1960s.

For Taiwan, Bongaarts and Feeney (1998) state that required data is available from the mid 1970s and on, they have applied the adjustments to the period from 1978 to 1993. The tempo effects for this period were found to be between about -0.25 and -0.4.

Philipov and Kohler (2001) have applied the adjustment on five Eastern European countries: Bulgaria, the Czech Republic, Hungary, Poland, and Russia, for each of the 10 years between 1989 and 1998. A summary table of their findings is given below:

**Table 4.3.2.1** Values of TFRs and AdjTFRs for five Eastern European Countries

| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Bulgaria** | | | | | | | | | | |
| TFR | 1.92 | 1.82 | 1.64 | 1.55 | 1.46 | 1.37 | 1.24 | 1.23 | 1.09 | 1.11 |
| AdjTFR | 2.03 | 1.74 | 1.58 | 1.58 | 1.60 | 1.66 | 1.60 | 1.70 | 1.38 | - |
| Mean age | 24.00 | 24.00 | 23.80 | 23.80 | 23.90 | 24.10 | 24.20 | 24.30 | 24.50 | 24.50 |
| **Czech Republic** | | | | | | | | | | |
| TFR | 1.87 | 1.89 | 1.86 | 1.71 | 1.68 | 1.44 | 1.28 | 1.18 | 1.17 | 1.16 |
| AdjTFR | 1.94 | 1.92 | 1.93 | 1.86 | 2.06 | 2.09 | 1.96 | 1.78 | 1.70 | - |
| Mean age | 24.70 | 24.80 | 24.70 | 24.80 | 25.00 | 25.40 | 25.80 | 26.10 | 26.40 | 26.60 |
| **Hungary** | | | | | | | | | | |
| TFR | 1.82 | 1.87 | 1.88 | 1.78 | 1.69 | 1.64 | 1.57 | 1.46 | 1.39 | 1.33 |
| AdjTFR | 1.88 | 2.00 | 2.04 | 1.94 | 1.92 | 1.91 | 1.91 | 1.76 | 1.69 | - |
| Mean age | 25.50 | 25.60 | 25.70 | 25.80 | 26.00 | 26.20 | 26.30 | 26.50 | 26.70 | 26.80 |
| **Poland** | | | | | | | | | | |
| TFR | 2.09 | 2.05 | 2.07 | 1.95 | 1.86 | 1.81 | 1.62 | 1.59 | 1.51 | 1.44 |
| AdjTFR | - | 2.05 | 2.12 | 2.14 | 2.19 | 2.16 | 1.94 | 1.96 | 1.84 | - |
| Mean age | 26.00 | 26.00 | 26.00 | 26.10 | 26.40 | 26.60 | 26.70 | 26.80 | 26.90 | 27.20 |
| **Russia** | | | | | | | | | | |
| TFR | 2.02 | 1.89 | 1.74 | 1.55 | 1.36 | 1.38 | 1.34 | 1.27 | 1.22 | 1.24 |
| AdjTFR | - | 1.71 | 1.64 | 1.51 | 1.34 | 1.51 | 1.63 | 1.70 | 1.45 | - |
| Mean age | 25.50 | 25.20 | 25.00 | 24.90 | 24.70 | 24.60 | 24.80 | 25.00 | 25.20 | 25.40 |

*Source: Philipov and Kohler, 2001*

According to Philipov and Kohler's calculations, largest values of tempo distortions are found in the Czech Republic, with a value of -0.68 in 1996 and -0.65 in 1995. The authors have concluded that an increase can be observed in tempo effects with time. They suggest that the decrease in TFRs in the first five years are more associated with quantum effects, however, tempo effects are greater in the last five years.

Sobotka (2004) has a study that aims to see whether lowest-low fertility in Europe is explained by the postponement of births. The study additionally has an objective of examining the differences between period fertility rates of European countries and regions after eliminating tempo effects. The author has obtained data mostly from vital registrations, and has additionally used some estimations from several studies by other demographers.

Sobotka has made the adjustments annually for the period 1995-2000 where available, and has taken their averages at the end to smooth out the annual fluctuations and irregularities. According to his calculations, he has obtained the values given in Table 4.3.2.2.

In the light of the data presented in Table 4.3.2.2, Sobotka has concluded that the variability in fertility rates still exists after the elimination of tempo effects. However, he states that it decreases within the AdjTFRs. According to the results obtained form this study, the largest tempo effect is found in the Czech Republic with a value of -0.55, a result that is parallel to the findings of Philipov and Kohler's study mentioned above.

Regional comparisons are also made between European countries, the results of which are given below in Table 4.3.2.3. Sobotka (2004) concludes from these calculations that Europe is characterized by considerable regional differences in tempo effects and adjusted TFRs.

**Table 4.3.2.2** Values of TFRs and AdjTFRs for some European Countries

| | Period | TFR | AdjTFR | Tempo effect |
|---|---|---|---|---|
| Austria | 1995-2000 | 1.36 | 1.58 | -0.22 |
| France | 1999 | 1.79 | 1.96 | -0.17 |
| West Germany | 1992-1994 | 1.38 | 1.51 | -0.13 |
| Ireland | 1995-2000 | 1.89 | 2.18 | -0.29 |
| Netherlands | 1995-2000 | 1.6 | 1.73 | -0.13 |
| England and Wales | 1995-2000 | 1.71 | 1.85 | -0.14 |
| Denmark | 1993-1995 | 1.79 | 2.04 | -0.25 |
| Finland | 1995-2000 | 1.75 | 1.89 | -0.14 |
| Iceland | 1995-2000 | 2.06 | 2.34 | -0.28 |
| Norway | 1995-2000 | 1.85 | 2.07 | -0.22 |
| Sweden | 1995-2000 | 1.57 | 1.85 | -0.28 |
| Greece | 1995-1998 | 1.3 | 1.63 | -0.33 |
| Italy | 1993-1996 | 1.21 | 1.64 | -0.43 |
| Portugal | 1995-2000 | 1.47 | 1.73 | -0.26 |
| Spain | 1995-1999 | 1.18 | 1.46 | -0.28 |
| Czech Republic | 1995-2000 | 1.18 | 1.73 | -0.55 |
| Hungary | 1995-1998 | 1.44 | 1.76 | -0.32 |
| Poland | 1995-2000 | 1.48 | 1.76 | -0.28 |
| Slovakia | 1995-2000 | 1.4 | 1.74 | -0.34 |
| Slovenia | 1995-2000 | 1.26 | 1.68 | -0.42 |
| Estonia | 1996-2000 | 1.28 | 1.77 | -0.49 |
| Latvia | 1998-2000 | 1.17 | 1.55 | -0.38 |
| Lithuania | 1995-1999 | 1.40 | 1.65 | -0.25 |
| Bulgaria | 1995-2000 | 1.20 | 1.48 | -0.28 |
| Macedonia | 1995-1999 | 1.91 | 2.13 | -0.22 |
| Romania | 1995-1999 | 1.31 | 1.52 | -0.21 |
| Russia | 1992-1996 | 1.37 | 1.45 | -0.08 |

*Source: Sobotka, 2004*

**Table 4.3.2.3** Values of TFRs and AdjTFRs for European Regions

| | TFR | AdjTFR | Tempo effect | CTFR (1960) |
|---|---|---|---|---|
| Western Europe | 1.57 | 1.74 | -0.17 | 1.88 |
| Northern Europe | 1.70 | 1.94 | -0.24 | 2.00 |
| Southern Europe | 1.23 | 1.59 | -0.36 | 1.74 |
| Central Europe | 1.41 | 1.75 | -0.34 | 2.12 |
| Baltic Countries | 1.30 | 1.64 | -0.34 | 1.92 |
| Southeastern Europe | 1.43 | 1.67 | -0.24 | 2.14 |
| Eastern Europe | 1.25 | 1.46 | -0.21 | 1.85 |

*Source: Sobotka, 2004*

Imhoff and Keilman (2000) have published a comment paper on the Bongaarts and Feeney adjustment, the details of which were mentioned in Section 4.2. This study includes an empirical application as well as theoretical arguments on the method. The application is on data from Netherlands, for the period of 1950-1997, in which the post war baby boom period can clearly be observed. The data points from this study are not available.

Another study by Sobotka (2003) compares several period fertility indicators, one of which is the adjusted TFR proposed by Bongaarts and Feeney (1998). Adjusted TFR, TFR, PATFR (explained in Chapter 2.3.3), adjusted PATFR (explained in Chapter 2.3.2) and comTFR (and indicator that combines AdjTFR for the first two parities, and TFR for higher birth orders in this study) are compared for four European countries, namely Czech Republic, Italy, the Netherlands and Sweden in this study. For Czech Republic, annual TFR, AdjTFR, PATFR, AdjTFR and comTFR values are computed for the period 1965-2000. For Sweden, some indicators are available from 1974 to 2000, and some are available for a shorter period within 1974-2000 period. The same applies to Italy and the Netherlands for the periods 1965-2000. The data from this study is presented in its appendix.

Another article on low fertility in Europe was published by Lesthaeghe and Willems (1999). This study focuses on whether low fertility in Europe is temporary or not. This theme is discussed in many studies, it is a matter of debate whether postponements in childbearing will eventually come to a halt and period fertility levels will recover or not. The authors have carried out some population projections as well as applying Bongaarts and Feeney's adjustment formula on three European countries: Italy, Belgium and France. Their descriptive findings are summarized in the table below, and are given here for the sake of comparison to the results in Chapter 5.1.

**Table 4.3.2.4** Order specific TFRs and mean ages at childbearing, Italy, Belgium and France

| | **Birth order 1** | | **Birth order 2** | | **Birth order 3** | | **Birth order 4+** | | **TFR** | **Adj TFR** |
|---|---|---|---|---|---|---|---|---|---|---|
| | **TFR1** | **MAC1** | **TFR2** | **MAC1** | **TFR3** | **MAC1** | **TFR4+** | **MAC1** | | |
| **Italy** | | | | | | | | | | |
| **1970** | 0.94 | 24.6 | 0.76 | 27.8 | 0.37 | 30.3 | 0.27 | 33.3 | 2.34 | - |
| **1980** | 0.771 | 24.6 | 0.58 | 27.6 | 0.21 | 30.2 | 0.08 | 34 | 1.64 | 1.64 |
| **1990** | 0.63 | 26.4 | 0.47 | 29.3 | 0.16 | 31.8 | 0.08 | 34.7 | 1.34 | 1.6 |
| **1995** | 0.6 | 28 | 0.42 | 30.8 | 0.12 | 33.2 | 0.04 | 35.1 | 1.18 | 1.69 |
| $r_i$(1970-80) | | 0 | | -0.02 | | -0.01 | | 0.07 | | |
| $r_i$(1980-90) | | 0.18 | | 0.17 | | 0.16 | | 0.07 | | |
| $r_i$(1990-95) | | 0.32 | | 0.3 | | 0.28 | | 0.08 | | |
| **Belgium** | | | | | | | | | | |
| **1970** | 0.93 | 24.4 | 0.64 | 27 | 0.33 | 29.5 | 0.34 | 32.7 | 2.24 | - |
| **1980** | 0.8 | 24.8 | 0.54 | 27.1 | 0.21 | 29.4 | 0.12 | 31.8 | 1.67 | 1.7 |
| **1988** | 0.74 | 26.2 | 0.51 | 28.1 | 0.21 | 30.1 | 0.11 | 30.6 | 1.57 | 1.81 |
| $r_i$(1970-80) | | 0.04 | | 0.01 | | -0.01 | | -0.09 | | |
| $r_i$(1980-88) | | 0.18 | | 0.13 | | 0.09 | | -0.15 | | |
| **France** | | | | | | | | | | |
| **1970** | 0.91 | 24 | 0.72 | 26.8 | 0.4 | 29.1 | 0.44 | 32.6 | 2.47 | - |
| **1980** | 0.82 | 24.6 | 0.68 | 27.2 | 0.31 | 29.2 | 0.14 | 32.4 | 1.95 | 2.03 |
| **1989** | 0.77 | 26.2 | 0.59 | 28.5 | 0.3 | 30.4 | 0.13 | 33.3 | 1.79 | 2.01 |
| $r_i$(1970-80) | | 0.06 | | 0.04 | | 0.01 | | -0.02 | | |
| $r_i$(1980-89) | | 0.18 | | 0.14 | | 0.13 | | 0.10 | | |

*Source: Lesthaeghe and Willems, 1999*

The difference in this application of Bongaarts and Feeney adjustment is that the change in the mean age at childbearing during specific time period is used to adjust the TFR value of the recently observed period. This, as mentioned in section 2.4.2, is the reverse of what Bongaarts (1999) has applied for the example of Colombia.

Theoretically, the authors have supported their study with data on female education, female labour force participation in addition to discussions on ideational changes in Europe. They claim that these are the key determinants of fertility decline in Europe. As for recovery of TFR, a third stage of the second demographic transition is mentioned by the authors, in which postponement of childbearing is expected to stop causing tempo effects to diminish. The authors conclude their study with a caution that the Bongaarts and Feeney model is not recommended as a prospective tool unless used carefully.

A study by Imhoff (2001) discusses the possibility of inferring cohort fertility measures from period fertility measures. This article includes empirical applications as well to support its arguments. In addition to other measures, conventional and adjusted TFR values are calculated for two countries, the Netherlands and Italy. A summary of findings is given below.

**Table 4.3.2.5** Summary findings from the applications of Imhoff (2001)

| | **Completed fertility for cohorts born around 1970 and later** | |
|---|---|---|
| | **Netherlands** | **Italy** |
| **Birth order 1** | 0.8 | 0.75-0.80 |
| **Birth order 2** | 0.65-0.70 | 0.55-0.60 |
| **Birth order 3** | 0.2 | 0.15-0.20 |
| **Birth order 4** | 0.05-0.10 | 0.05 |
| **Total completed family size** | 1.70-1.80 | 1.50-1.65 |
| **Period TFR 1990s** | 1.50-1.65 | 1.20-1.35 |
| **B-F adjusted TFR 1990s** | 1.70-1.95 | 1.50-1.70 |

*Source: Imhoff, 2001*

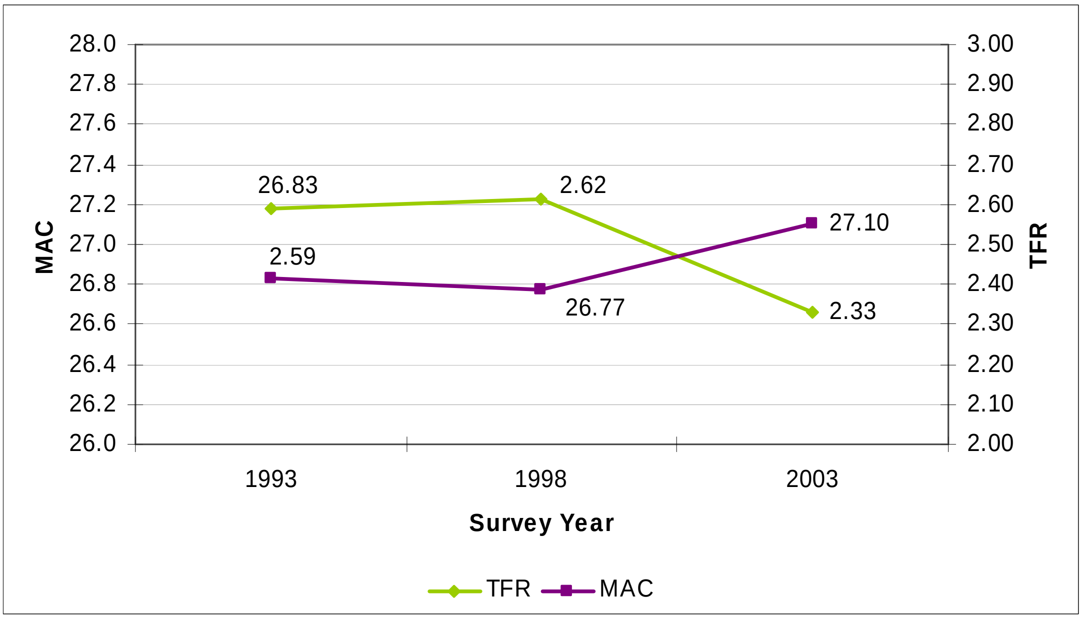
# CHAPTER V
# RESULTS

## 5.1. DESCRIPTIVE RESULTS

### 5.1.1. Overall Results for Turkey

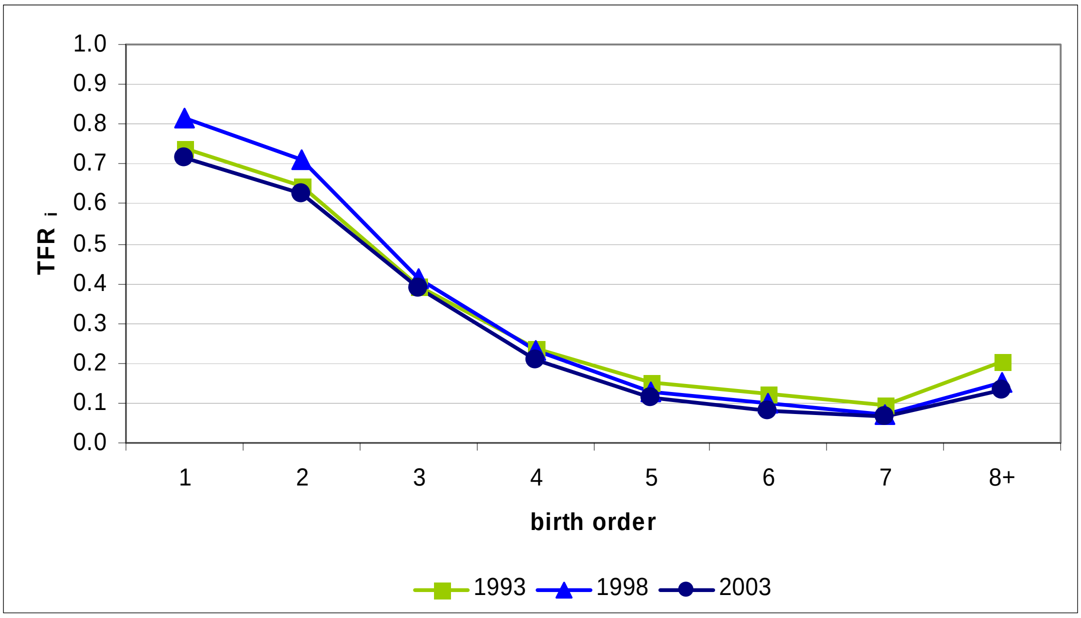
As given in section 3.2.2., TFR in Turkey has fallen from 2.7 in 1993 to 2.6 in 1998, and finally to 2.3 in 2003. The values of TFR for 1993 and 2003 are calculated for the three year periods preceding survey date, whereas 1998 is calculated for the single year preceding survey date. However, the falling trend changes if all are calculated from the five year periods preceding survey date.

**Figure 5.1.1** The distribution of TFR according to birth orders, 1993, 1998 and 2003




The symmetry with respect to the x-axis on the above figure clearly shows the relationship between timing of fertility and TFR. It additionally suggests a possibility that births have been advanced after 1993. However, since MAC is composite, this is not for certain. The distribution of these total fertility rates with respect to birth orders is as shown below.

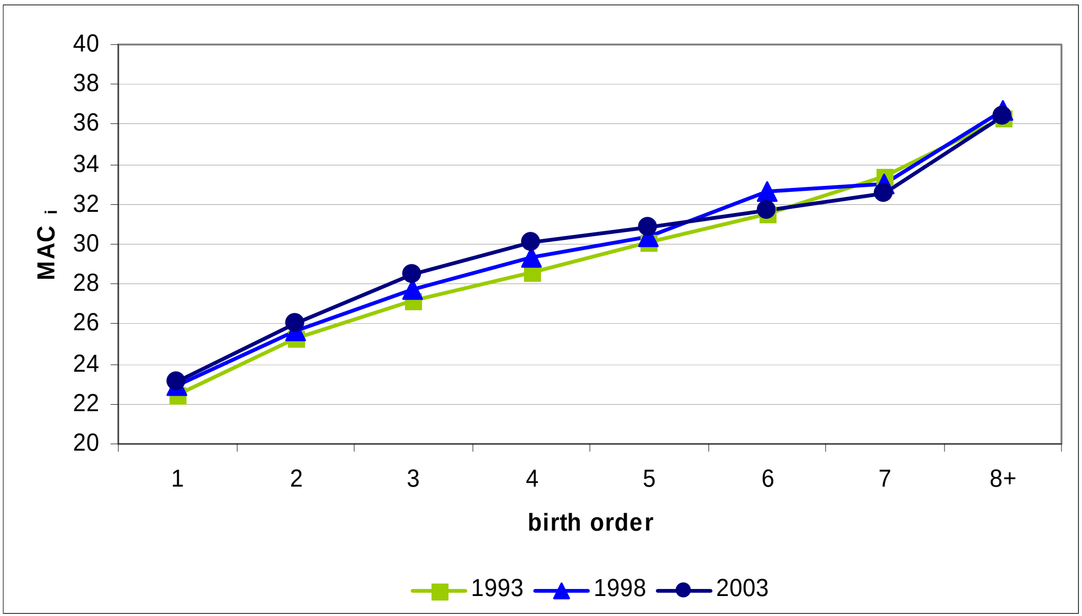
**Figure 5.1.2** The distribution of TFR according to birth orders, 1993, 1998 and 2003




An interesting result of this decomposition is to see that the first orders of TFR for 1998 are the highest among all. Rather than 1998 showing a TFR level higher than 1998, the relatively low level of 1993 may be suspicious if a downward trend exists. The TFR calculated from one year preceding the 1988 Turkish Population and Health Survey is 3,02, the decline to a 2.65 (also calculated from one year preceding the survey) in 1993 is rapid. The $TFR_1$ values for 1993 and 2003 are close to 0.7, which means 70% of women of childbearing have a first child. These values suggest a possible tempo effect, since it is known that almost all women of reproductive ages in Turkey have at least one birth. The $TFR_1$ of 1998 however, is over 0.8. This suggests that births may be advanced from 1993 to 1998. Another important point to be noted is the decrease in higher order births; they show a trend unlike the first birth orders. The decline is steady after the fourth birth order.

Figure 5.1.3 suggests that there has generally been a uniform increase in the mean age at childbearing from 1993 to 2003, contradictory to changes in order specific total fertility rates. The steep rise from birth order 7 to 8+ is likely to be due to higher order births included in 8+. The mean age at first birth increased from 22.49 to 23.12 (Appendix C) from 1993 to 2003. The increases for third and fourth births are larger; the mean age at third birth has increased by 1.38 years for third birth and 1.49 years for fourth birth between these surveys.

**Figure 5.1.3** Birth order specific mean ages at childbearing, 1993, 1998, 2003



### 5.1.2. Overall Results for Variables

The differences between the categories of different variables are as expected, urban residences have lower fertility rates and lower mean ages at childbearing. This is possibly due to the small share of higher order births in this region. West region has the lowest TFR; it also does not have the lowest mean age at childbearing among regions. East region having the highest mean age at childbearing supports this possibility. Among migration categories, urban native women have the lowest fertility rates, followed by rural to urban migrants. Thus women who are currently living in urban areas tend to have lower fertility, however, while making this comment, it should be kept in mind that the number of cases for urban to rural migrants is relatively low; the indicators calculated from this category may not be as reliable as the other categories. The mother tongue variable indicates that women who speak Kurdish as their mother tongue tend to have about twice the fertility rate of those who speak Turkish as their mother tongue. Women who are graduates second level primary school or have higher education have the lowest fertility rates within other categories, and they have the highest mean ages at childbearing.

**Table 5.1.1** Total fertility rate and mean age at childbearing by survey years

| | TFR | | | MAC | | |
|---|---|---|---|---|---|---|
| | 1993 | 1998 | 2003 | 1993 | 1998 | 2003 |
| **Type of Residence** | | | | | | |
| Urban | 2.39 | 2.39 | 2.13 | 26.6 | 26.7 | 26.9 |
| Rural | 2.94 | 3.10 | 2.83 | 27.3 | 26.9 | 27.5 |
| **Region** | | | | | | |
| West | 1.98 | 2.03 | 1.89 | 25.7 | 26.3 | 26.7 |
| North | 2.71 | 2.69 | 2.05 | 26.7 | 26.6 | 26.8 |
| Central | 2.51 | 2.55 | 2.09 | 26.3 | 25.8 | 26.4 |
| South | 2.45 | 2.59 | 2.32 | 27.1 | 27.0 | 27.3 |
| East | 4.30 | 4.34 | 3.90 | 28.8 | 28.5 | 28.7 |
| **Migration categories** | | | | | | |
| Urban native | 2.33 | 2.16 | 1.84 | 26.6 | 26.7 | 27.1 |
| Urban to rural migrant | 3.26 | 3.82 | 3.36 | 27.9 | 27.4 | 26.2 |
| Rural native | 2.95 | 3.07 | 2.78 | 27.3 | 27.0 | 27.7 |
| Rural to urban migrant | 2.49 | 2.95 | 2.93 | 26.5 | 25.8 | 25.9 |
| **Mother tongue** | | | | | | |
| Turkish | 2.30 | 2.29 | 1.98 | 26.4 | 26.4 | 26.8 |
| Kurdish | 4.81 | 4.30 | 4.37 | 26.9 | 28.6 | 26.9 |
| Other | 2.57 | 4.42 | 3.05 | 26.5 | 25.8 | 25.9 |
| **Educational attainment** | | | | | | |
| No education/ primary incomplete | 3.92 | 4.03 | 3.97 | 26.6 | 26.8 | 27.2 |
| First level primary | 2.28 | 2.51 | 2.44 | 25.6 | 25.8 | 25.7 |
| Second level primary or higher | 1.72 | 1.73 | 1.54 | 27.8 | 27.4 | 27.8 |
| **Turkey** | 2.59 | 2.62 | 2.33 | 26.8 | 26.8 | 27.1 |

**Table 5.1.2** Birth order-specific total fertility rates and mean ages at childbearing by type of place of residence

| | | Urban | | | Rural | |
|---|---|---|---|---|---|---|
| | **1993** | **1998** | **2003** | **1993** | **1998** | **2003** |
| **TFRi** | | | | | | |
| **1** | 0.78 | 0.80 | 0.73 | 0.65 | 0.83 | 0.68 |
| **2** | 0.65 | 0.70 | 0.63 | 0.62 | 0.72 | 0.63 |
| **3** | 0.38 | 0.38 | 0.36 | 0.42 | 0.49 | 0.47 |
| **4** | 0.20 | 0.19 | 0.16 | 0.30 | 0.32 | 0.35 |
| **5** | 0.11 | 0.09 | 0.09 | 0.23 | 0.21 | 0.19 |
| **6** | 0.09 | 0.08 | 0.06 | 0.19 | 0.14 | 0.12 |
| **7** | 0.06 | 0.05 | 0.04 | 0.16 | 0.12 | 0.12 |
| **8+** | 0.11 | 0.09 | 0.07 | 0.37 | 0.28 | 0.28 |
| **TFR** | 2.39 | 2.39 | 2.13 | 2.94 | 3.10 | 2.83 |
| **MACi** | | | | | | |
| **1** | 22.7 | 23.0 | 23.4 | 22.1 | 22.8 | 22.3 |
| **2** | 25.8 | 26.2 | 26.4 | 24.5 | 24.6 | 25.1 |
| **3** | 27.7 | 28.3 | 28.9 | 26.3 | 26.8 | 27.7 |
| **4** | 29.3 | 29.9 | 30.6 | 27.9 | 28.5 | 29.5 |
| **5** | 30.5 | 31.1 | 31.4 | 29.6 | 29.6 | 30.1 |
| **6** | 32.5 | 33.7 | 31.7 | 30.8 | 31.1 | 31.6 |
| **7** | 33.2 | 33.3 | 31.7 | 33.5 | 32.6 | 33.1 |
| **8+** | 37.1 | 36.6 | 36.1 | 35.9 | 36.7 | 36.5 |
| **MAC** | 26.6 | 26.7 | 26.9 | 27.3 | 26.9 | 27.5 |

Table 5.1.2 shows that birth order specific total fertility rates decline for urban residences especially after second birth. Additionally, mean ages at childbearing are in fact higher in urban areas than in rural, contradictory to the values of overall mean age at childbearing.

Figure 5.1.4 shows the fact that births after second order start to decrease rapidly for urban areas. It also shows 2003 as having the lowest fertility rates for all birth orders. Similar to the graph of Turkey as a whole, 1998 has the highest values for the first two birth orders. Figure 5.1.5 also shows a similar pattern to that of Turkey. However, the distribution after fifth order is probably affected by the low number of cases in higher birth orders in urban residences, thus it does not show a regular pattern.

**Figure 5.1.4** Birth order-specific total fertility rates and for urban residences

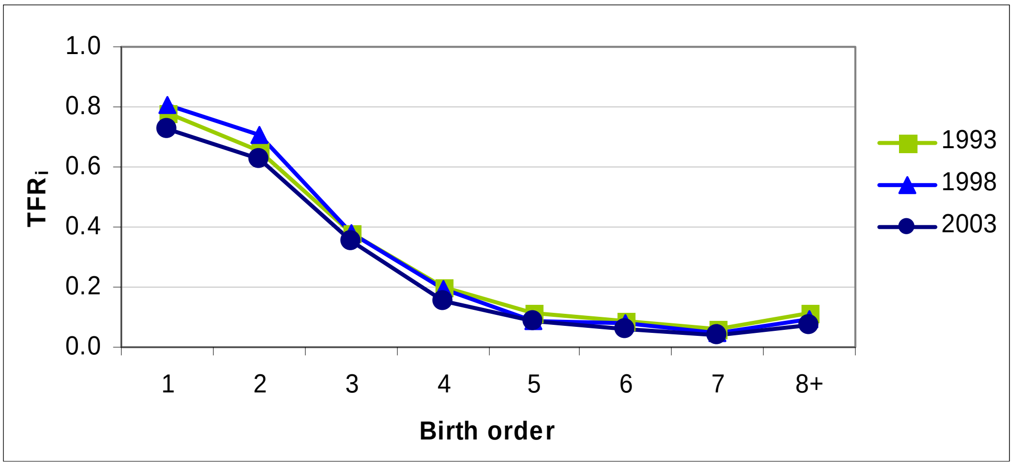
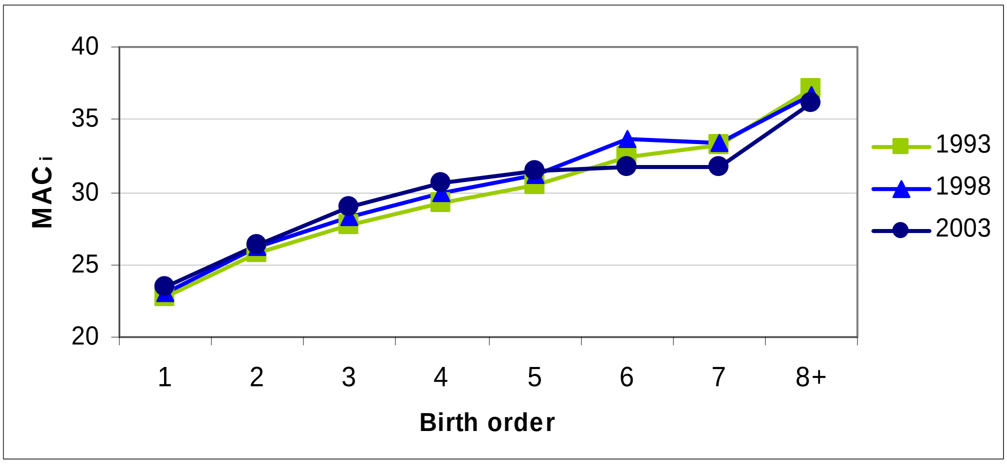



**Figure 5.1.5** Birth order-specific mean ages at childbearing for urban residences



According to Figures 5.1.4 and 5.1.6 one of the main differences of the TFR distribution by birth order according to urban and rural residences is the higher share of births of higher orders for rural residences. The incline from birth order 7 to 8+ is an indicator of this fact. Another difference is that the relatively steep fall after the second birth in urban residences does not exist in the rural. Figures 5.1.5 and 5.1.7 indicate that childbearing starts one year earlier on average in rural than urban according to TDHS 2003. Another difference to be observed is the more regular pattern of mean ages at childbearing in the higher birth orders in the rural.

**Figure 5.1.6** Birth order-specific total fertility rates for rural residences

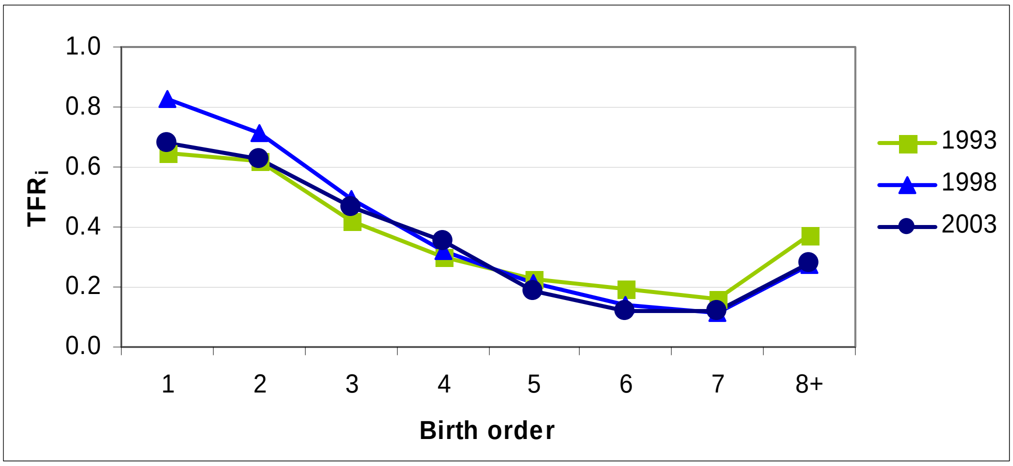



**Figure 5.1.7** Birth order-specific mean ages at childbearing for rural residences

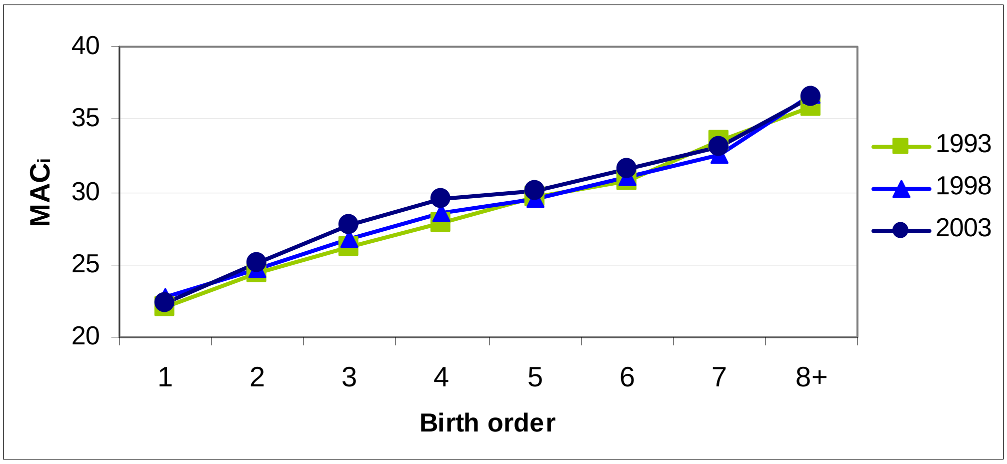


TABLE 5.1.3

According to Table 5.1.3, although eastern region has the highest TFR values, it has the lowest $TFR_1$ values that indicate about 64-72% of women in this region have first births. This might suggest that postponement in childbearing is more intense in this region. After second birth, western region has the lowest $TFR_i$ values. While almost all regions have $TFR_3$ values over 0.4, west has a highest of 0.29. Central region has very high mean ages at childbearing for the last birth orders, even higher than that of East, even though there are many births of order 9 and more in East.

**Figure 5.1.8** Birth order-specific total fertility rates for West

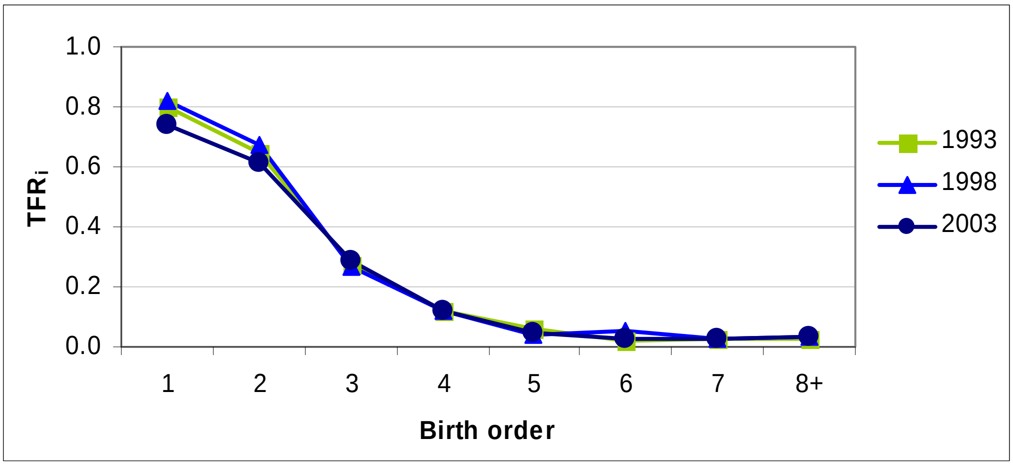



**Figure 5.1.9** Birth order-specific mean ages at childbearing for West

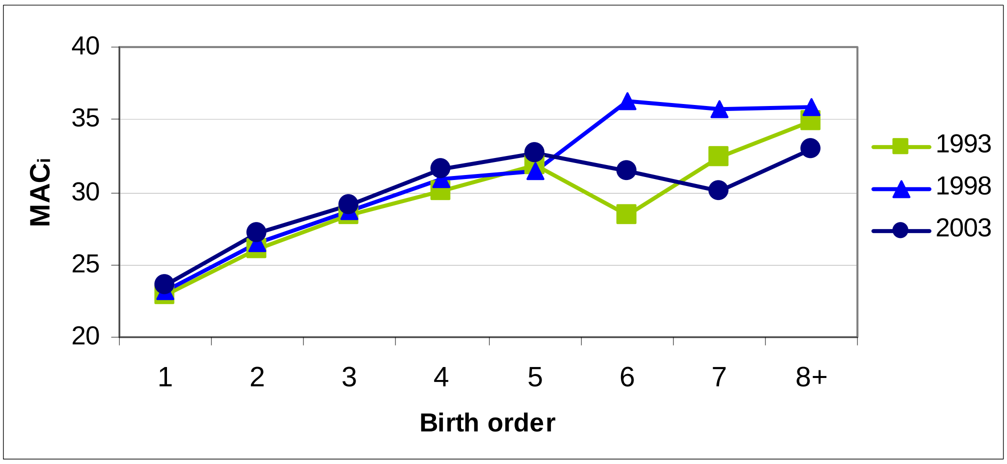


Figure 5.1.8 shows that almost no changes in order specific total fertility rates took place with respect to survey date. The clear pattern in this figure is low level of fertility after the second birth; it is even lower after fifth order. Mean ages at childbearing have increased for the first five birth orders, the inconsistent values afterwards are due to very low fertility in these birth orders, meaning a small number of cases.

**Figure 5.1.10** Birth order-specific total fertility rates for North

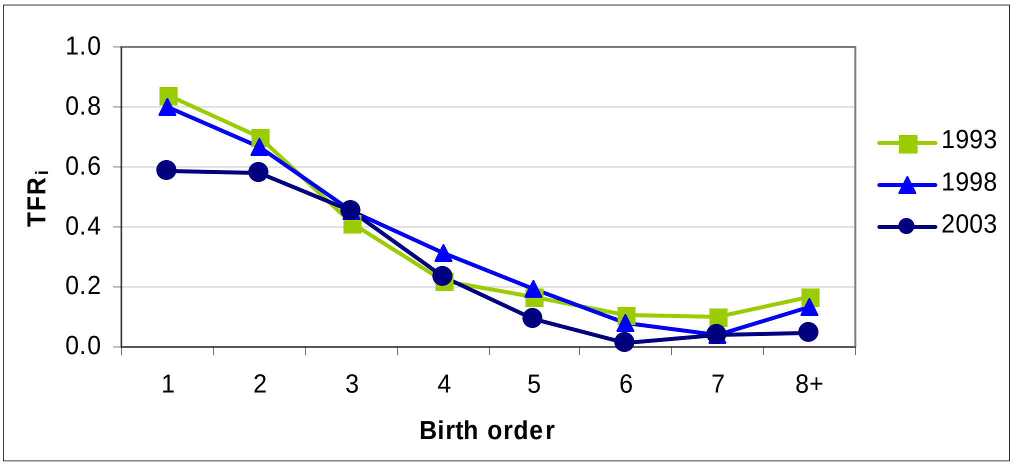
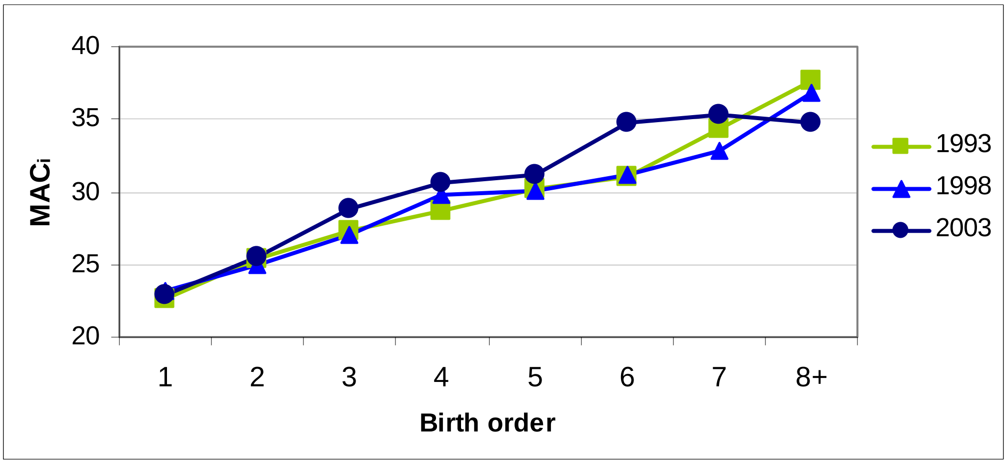



**Figure 5.1.11** Birth order-specific mean ages at childbearing for North




According to Figure 5.1.10, the shape of the distribution of TFR with respect to birth orders has changed in time, higher order birth decrease more rapidly in 2003. The value of the first order TFR has dramatically decreased in 2003, suggesting a postponement in births. There seems to be generally a linear decrease from the first birth order to the fifth one, unlike the pattern of decreasing more rapidly after second order in west. The levels of fertility of higher order births have decreased in time. Figure 5.1.11 shows that mean ages at childbearing have increased for all birth orders in 2003.

Comparing Figure 5.1.12 to 5.1.10, it is possible to see the differences in the shape of the distribution of order specific TFR values. The shape from the first birth order is more of a curve than a line in Figure 5.1.12, births decrease rapidly after the second birth in central region. The plots from 2003 suggest that births have decreased for all birth orders after the second one. A rise in mean age at childbearing is also seen in Figure 5.1.13, the irregular shapes in the higher birth orders are again due to the low proportion of births in these birth orders.

**Figure 5.1.12** Birth order-specific total fertility rates for Central

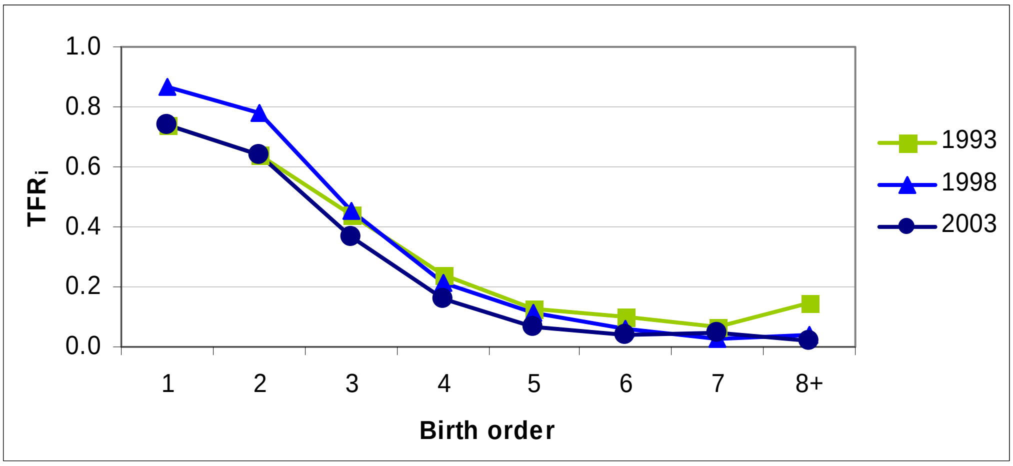
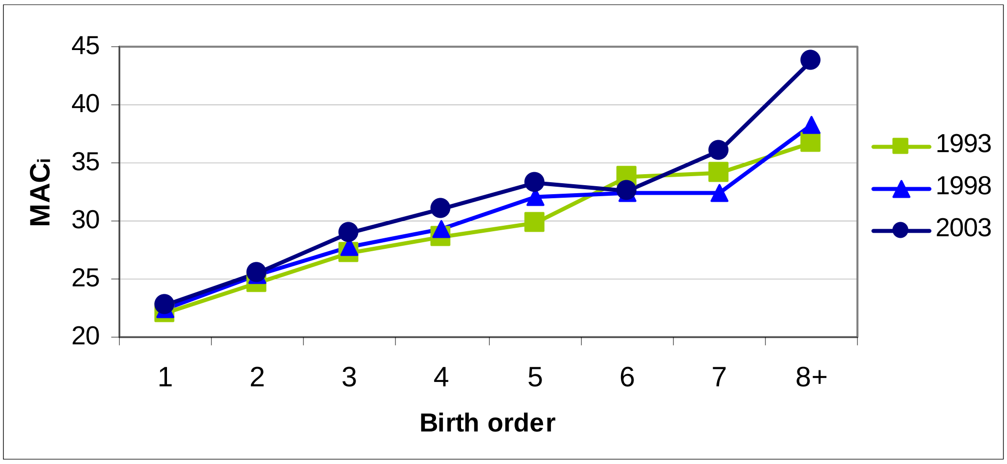


**Figure 5.1.13** Birth order-specific mean ages at childbearing for Central




According to Figure 5.1.14, similar to north, southern region also shows a decline that is almost linear from first to fifth birth. There seems to be a slight increase in the $TFR_{8+}$ values compared to $TFR_7$ for all survey years, showing that the share of higher births in this region is relatively high. Mean ages at childbearing have increased for the second and third birth orders, although they have remained constant for the first and second orders (Figure 5.1.15).

**Figure 5.1.14** Birth order-specific total fertility rates for South

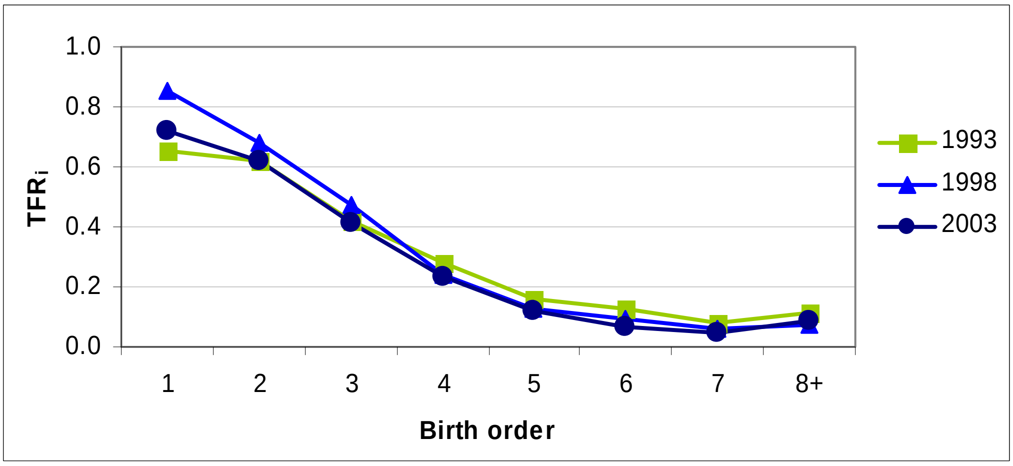
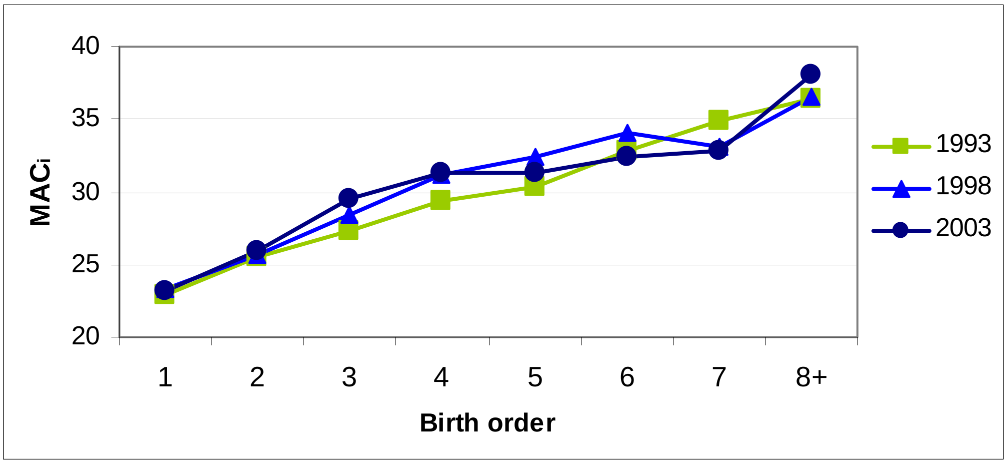


**Figure 5.1.15** Birth order-specific mean ages at childbearing for South




Eastern region not only differs from the other regions in the level of fertility, but also differs in the distribution of TFR according to birth orders (Figure 5.1.16). The level of births in the 8+ birth orders is especially high. The levels of the first three birth orders are close. The decrease from the first to higher birth orders is gradual. Figure 5.1.17 suggests that small changes have taken place in the timing of childbearing; however, the small changes show an increasing trend. The mean age at 8+ births shows a sudden increase due to the even higher birth orders this group includes.

**Figure 5.1.16** Birth order-specific total fertility rates for East

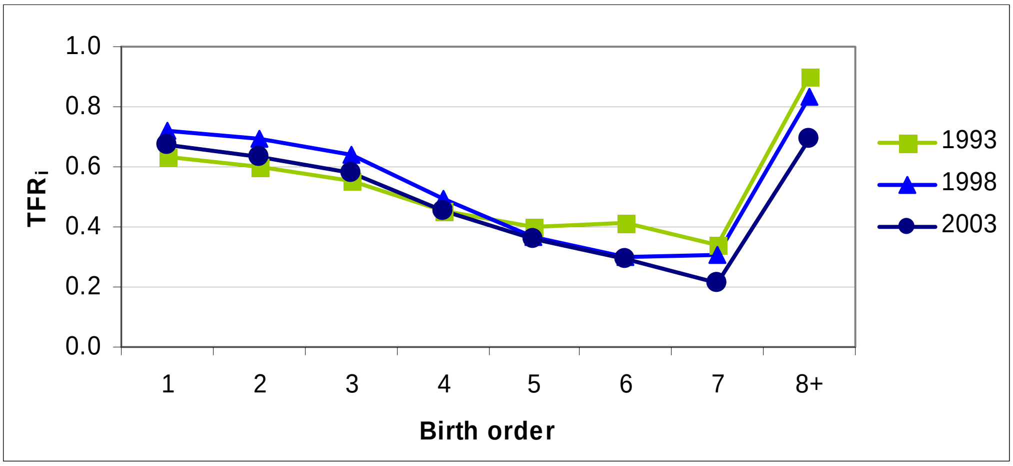
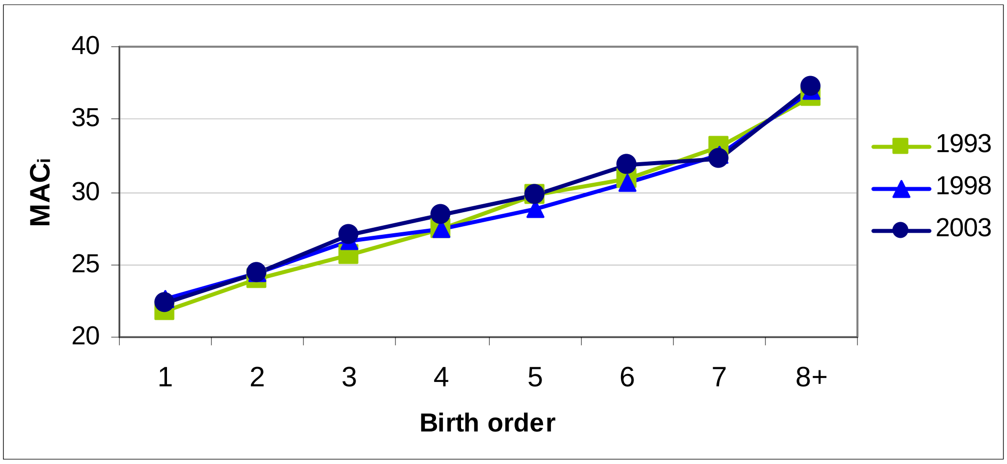


**Figure 5.1.17** Birth order-specific mean ages at childbearing for East



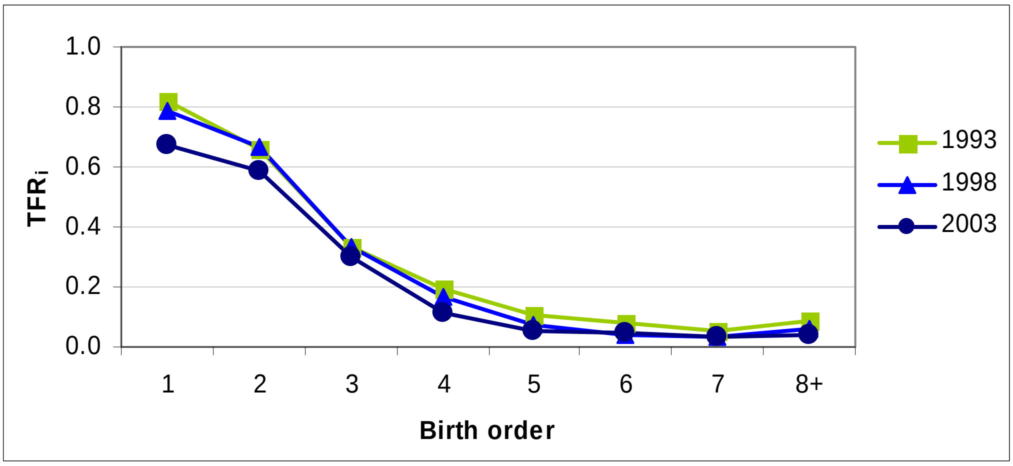

As was seen in Table 5.1.3, eastern region has the lowest mean ages at first birth, very probably related to the lower mean ages at first marriage in this region. The median age at first birth is 19,0 for East (for women of ages 25-49) according to TDHS 2003, which is the lowest among all regions, and 1,7 years lower than the region with the highest median age at first marriage.

TABLE 5.1.4

The results given in Table 5.1.4 reveal interesting points. Rural natives do not have the lowest levels of fertility as expected depending on the literature, rather urban to rural migrants do. Either this is actually the case, or there exists a problem. The category of urban to rural migrants have the lowest number of cases among others, this might lessen the reliability of this category. Another problem might be about the definition of the variable, the defined childhood place of residence variable may not be a good representative of women's years of social exposure or how long women have been living in their de jure type of place of residence may differ the results. How long women have been living in their de jure type of place of residence and where they lived before can be seen from data, however, number of cases become too few for the categories of such a variable. According to the table, the important factor seems to be the current place of residence. Urban natives, followed by rural to urban migrants have lower levels of fertility. This shows that migration is effective on the level of fertility.

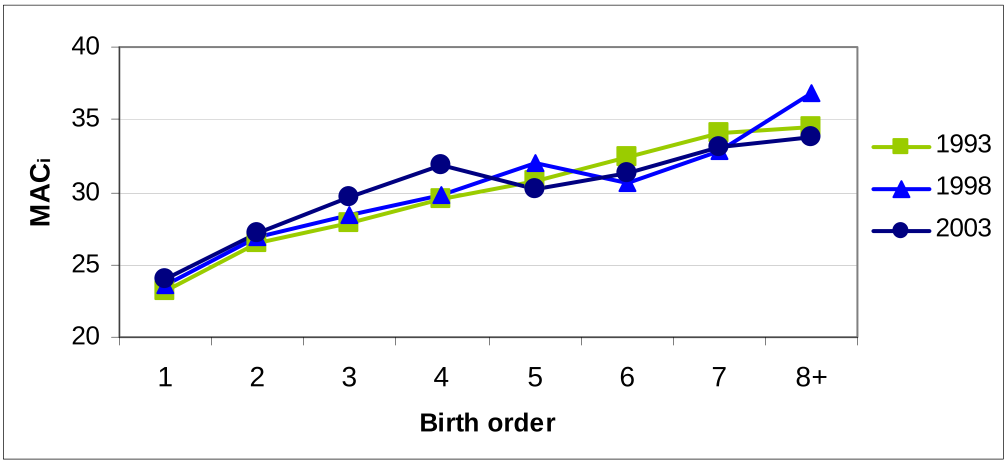
Urban natives enter childbearing the latest; in other categories the levels are not very different. The mean age at second birth is also higher for urban natives. The difference seems to decrease with increasing birth order. In overall mean ages at childbearing, rural to urban migrants seem to have the lowest values. There does not seem to be an increasing trend in mean age at first birth for all categories.

**Figure 5.1.18** Birth order-specific total fertility rates for urban natives



The general shape observed in Figure 5.1.18 is similar to that of Western region, seen in Figure 5.1.8 above. Level of fertility in higher birth orders is very small, and the fall from the second birth to third is steep. 2003 values show a decrease in level for all orders. Figure 5.19 shows close mean ages at first birth for the first two birth orders with respect to survey year; however, there is an increase in the mean ages of third and fourth births in 2003. Although the distribution of 1993 according to birth orders is smooth, it is not for 1998 and 2003 after fifth order, suggesting a decrease in the share of births in these births, thus lowering number of cases.

**Figure 5.1.19** Birth order-specific mean ages at childbearing for urban natives




Since the number of cases for the category urban to rural migrants is low, its figures will be presented in Appendix B.

**Figure 5.1.20** Birth order-specific total fertility rates for rural natives

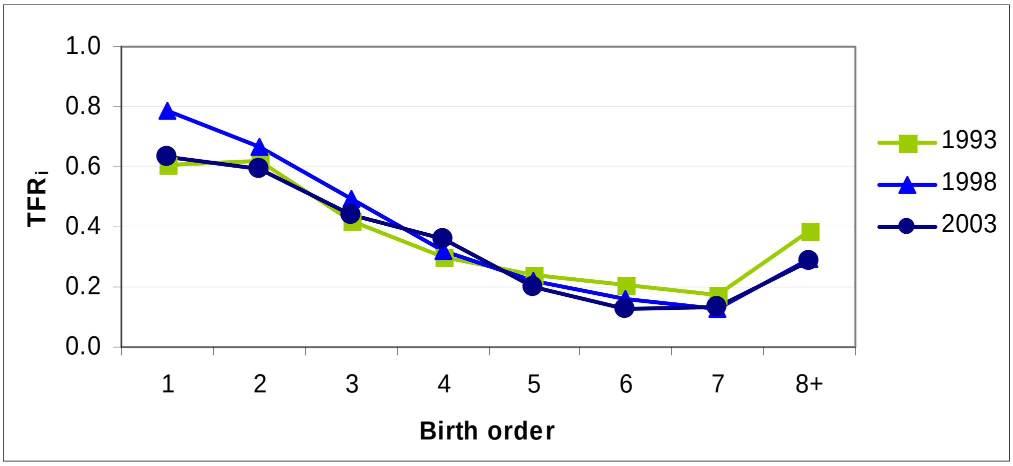



Figure 5.1.20 shows low levels of $TFR_1$ for 1993 and 2003, suggesting postponements in first birth. Compared to the figure for urban natives, the levels of higher order births, especially over eighth order are higher. The values from the 2003 survey are generally lower than those of the other two surveys.

The mean age at first birth does not seem to have changed throughout the three surveys for rural natives; however it has increased for the following three birth orders (Figure 5.1.21). Changes in the timing of higher order births have not been large.

**Figure 5.1.21** Birth order-specific mean ages at childbearing for rural natives

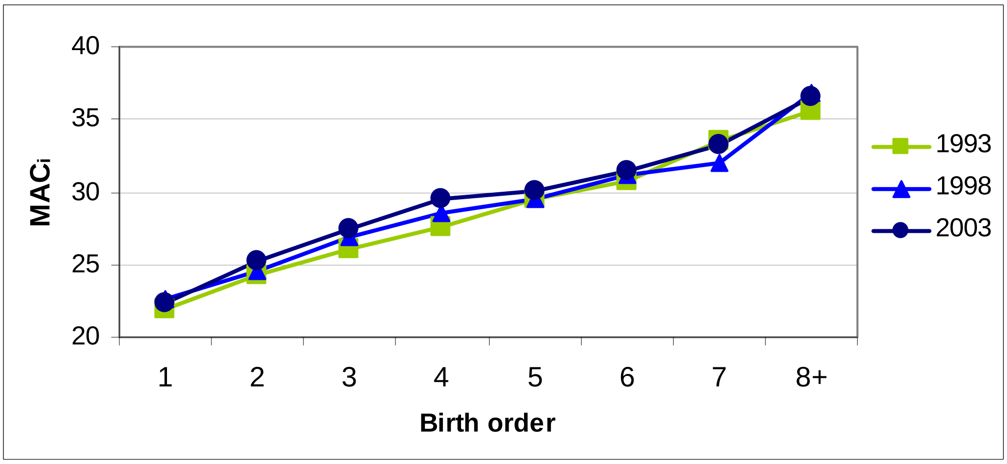
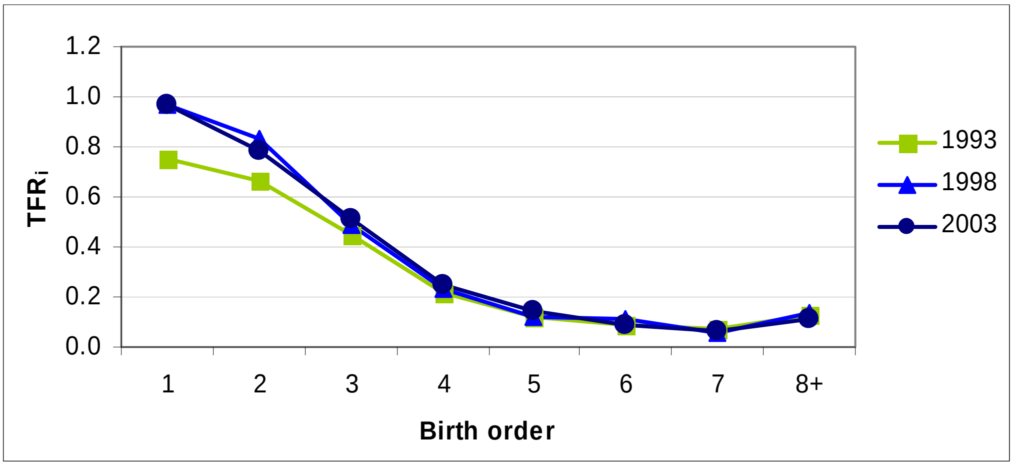


**Figure 5.1.22** Birth order-specific total fertility rates for Rural to urban migrants




According to figures 5.1.22 and 5.1.23, rural to urban migrants present an interesting situation; very small changes in both order specific total fertility rates and mean ages at births. The mean ages at first birth for 1998 and 2003 are very close to 1, implying no changes in the mean age at first birth. Figure 5.1.23 supports this view.

The diversities in timing after fifth birth order are probably due to low number of cases. By the situation seen in Figure 5.1.23, $TFR_i$ have remained the same for these births orders. This may suggest that there have been no changes in the timing of them as well, this could have been the case in Figure 5.1.23 were there more cases in these birth orders.

**Figure 5.1.23** Birth order-specific mean ages at childbearing for Rural to urban migrants

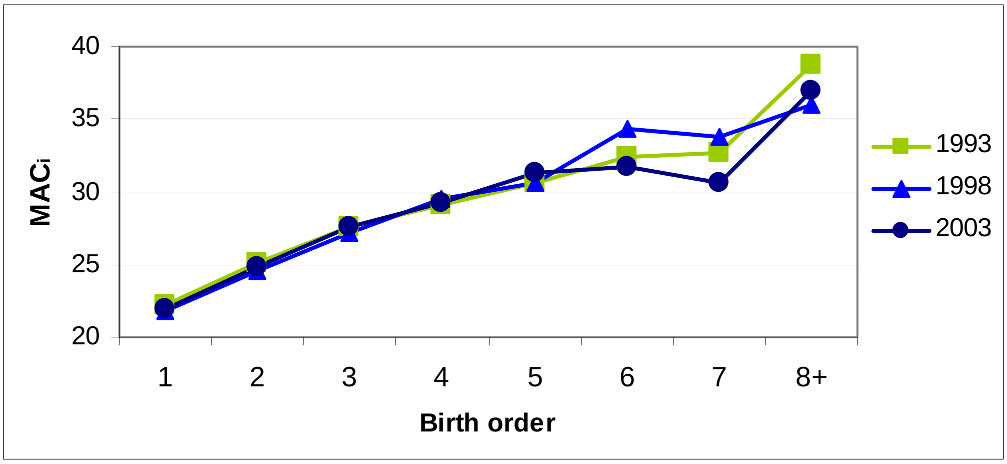


**Table 5.1.5** Birth order-specific total fertility rates and mean ages at childbearing by mother tongue

| | Turkish | | | Kurdish | | | Other | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1993 | 1998 | 2003 | 1993 | 1998 | 2003 | 1993 | 1998 | 2003 |
| **TFRi** | | | | | | | | | |
| **1** | 0.76 | 0.83 | 0.71 | 0.58 | 0.74 | 0.71 | 0.64 | 0.63 | 0.88 |
| **2** | 0.63 | 0.70 | 0.61 | 0.65 | 0.68 | 0.68 | 0.64 | 0.92 | 0.75 |
| **3** | 0.37 | 0.36 | 0.36 | 0.54 | 0.58 | 0.50 | 0.32 | 0.84 | 0.33 |
| **4** | 0.19 | 0.16 | 0.16 | 0.54 | 0.53 | 0.45 | 0.26 | 0.71 | 0.31 |
| **5** | 0.11 | 0.08 | 0.06 | 0.47 | 0.34 | 0.43 | 0.19 | 0.33 | 0.19 |
| **6** | 0.07 | 0.06 | 0.03 | 0.51 | 0.29 | 0.38 | 0.18 | 0.26 | 0.14 |
| **7** | 0.06 | 0.02 | 0.03 | 0.40 | 0.35 | 0.31 | 0.09 | 0.25 | 0.11 |
| **8+** | 0.10 | 0.06 | 0.02 | 1.11 | 0.79 | 0.91 | 0.27 | 0.46 | 0.34 |
| **TFR** | 2.30 | 2.29 | 1.98 | 4.81 | 4.30 | 4.37 | 2.57 | 4.42 | 3.05 |
| **MACi** | | | | | | | | | |
| **1** | 22.6 | 23.0 | 23.3 | 20.8 | 22.5 | 22.0 | 23.9 | 21.6 | 23.4 |
| **2** | 25.7 | 26.0 | 26.4 | 23.4 | 24.1 | 24.4 | 24.3 | 24.5 | 25.8 |
| **3** | 27.7 | 28.4 | 29.3 | 24.7 | 25.8 | 25.7 | 27.8 | 25.9 | 27.3 |
| **4** | 29.4 | 30.4 | 31.7 | 26.9 | 27.6 | 27.4 | 28.9 | 29.5 | 26.7 |
| **5** | 30.6 | 31.7 | 33.1 | 30.0 | 28.0 | 29.4 | 26.2 | 31.1 | 27.8 |
| **6** | 32.6 | 33.7 | 33.7 | 31.3 | 30.7 | 31.3 | 26.4 | 36.2 | 28.8 |
| **7** | 33.7 | 32.8 | 35.0 | 33.5 | 33.5 | 31.7 | 32.5 | 34.0 | 31.5 |
| **8+** | 36.6 | 37.4 | 38.4 | 36.7 | 36.2 | 37.1 | 36.0 | 40.4 | 34.7 |
| **MAC** | 26.4 | 26.4 | 26.8 | 26.9 | 28.6 | 26.9 | 26.5 | 25.8 | 25.9 |

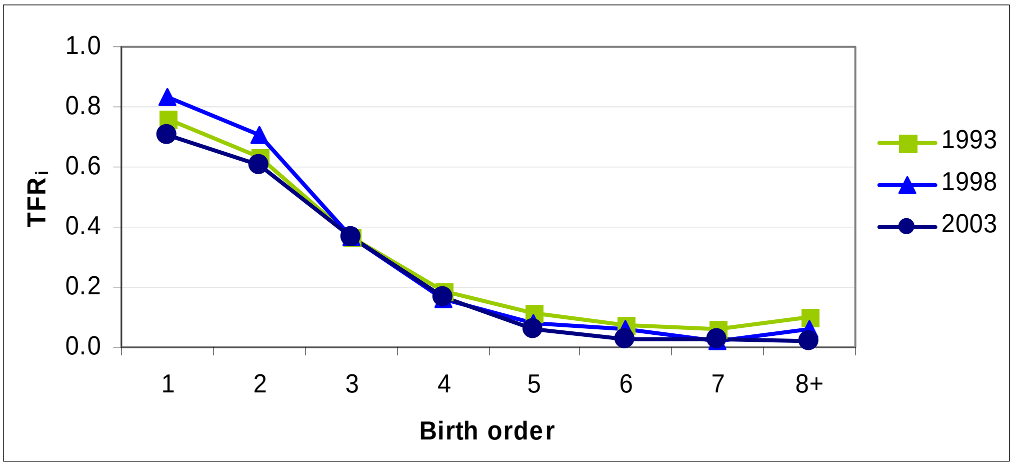
Table 5.1.5 shows the group of women who speak Kurdish as their mother tongue having the highest level of fertility. About 50% of women with Kurdish as their mother tongue have third fourth and fifth births. After fourth birth, $TFR_i$ levels fall under 0.1 for Turkish speaking women, such level almost does not exist for the other groups in any birth order. The total fertility rate of women who speak Turkish as mother tongue have reached a level that is under replacement by 2003. The group speaking other languages as mother tongue has a fertility level higher than Turkish and lower than Kurdish speaking women. The overall mean ages at birth do not differ very much among the groups. However, Kurdish speaking women have a lower age at first birth compared to others, they enter childbearing at earlier ages. The differences between mean ages at birth is especially high for 2003 between

Turkish and Kurdish speaking women, the difference begins with 1,3 years for the first birth, and it reaches 3.3 by seventh birth order.

Although presented in Table 5.1.5, the figures for women speaking languages other than Turkish or Kurdish will not be presented in this chapter, since the number of cases for this group is small. The figures may be found in Appendix B.

Figure 5.1.24 shows small changes for the level of fertility with time, the general pattern is especially low levels for higher birth orders. The level of $TFR_2$ is 0.61, while the level of $TFR_2$ is 0.36 according to 2003 TDHS, the proportion of women having the next child after second birth is about halved. The level of fertility after birth order 4 has decreased with time.

**Figure 5.1.24** Birth order-specific total fertility rates for Turkish mother tongue group



The mean age at childbearing has not changed much for the first and second birth orders, however, it is possible to observe an increase in the following birth orders (Figure 5.1.25). 2003 shows the higher ages for all birth orders.

**Figure 5.1.25** Birth order-specific mean ages at childbearing for Turkish mother tongue group

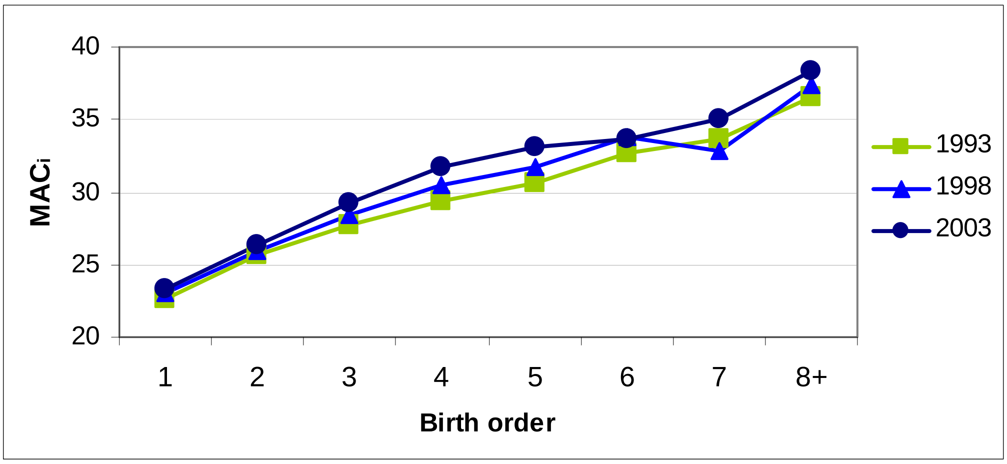
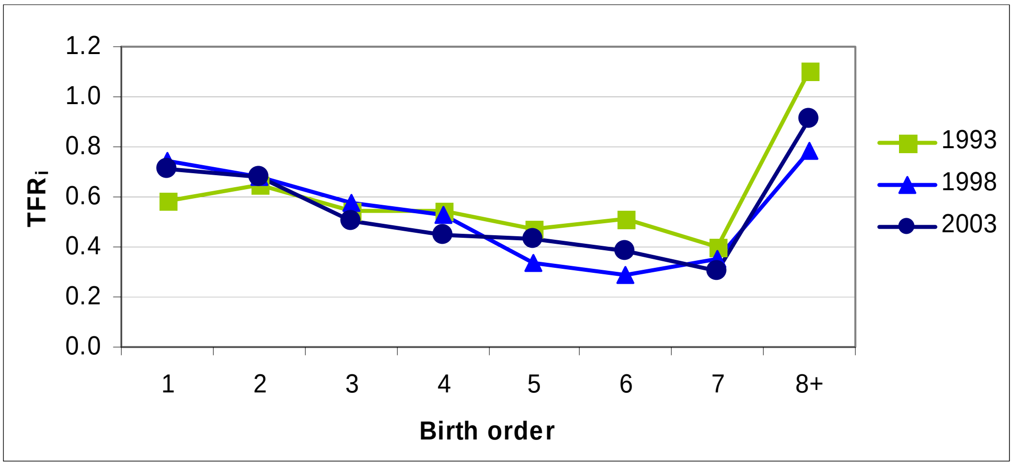



Figure 5.1.26 shows $TFR_1$ values lower than 0.8, which seem low for a group with high fertility. This might suggest postponements in first births. The decrease in $TFR_i$ from the first order to the seventh can said to be linear with a small magnitude of negative slope, unlike the rapidly decreasing curve shape in Figure 5.1.24. The level of births for births orders 8 and higher is very high, it exceeds 1 for 1993.

**Figure 5.1.26** Birth order-specific total fertility rates for Kurdish mother tongue group




Mean ages do not seem to have changed much for the Kurdish mother tongue group (Figure 5.1.27). It has increased for the first birth from 1993 to 1998 and 2003, about an amount of two years. The increases in order specific mean ages also seem to be linear.

**Figure 5.1.27** Birth order-specific mean ages at childbearing for Kurdish mother tongue group

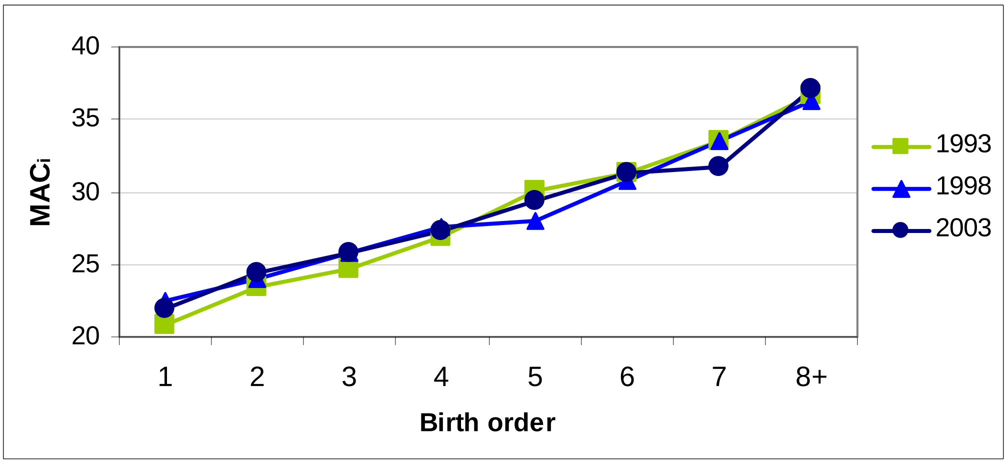


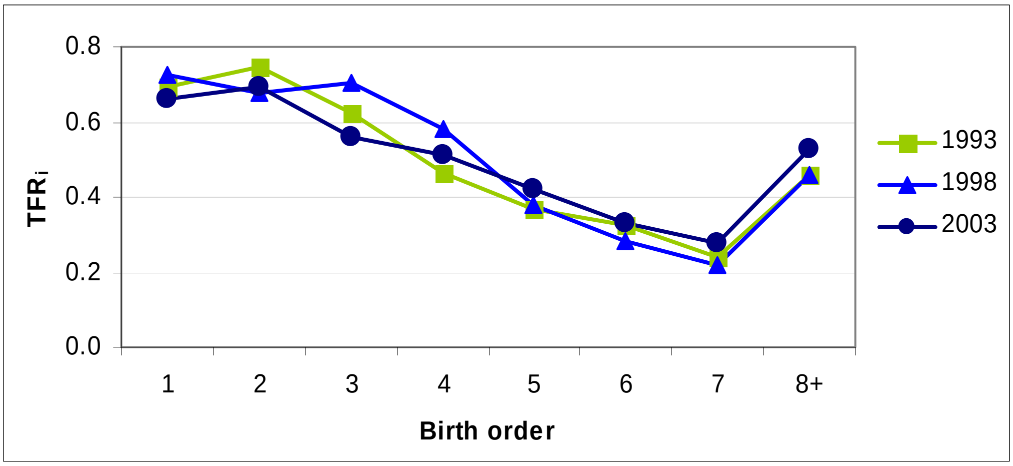
**Table 5.1.6** Birth order-specific total fertility rates and mean ages at childbearing by educational attainment

| | No education / First level primary | | | First level primary | | | Second level primary or higher | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1993** | **1998** | **2003** | **1993** | **1998** | **2003** | **1993** | **1998** | **2003** |
| **TFRi** | | | | | | | | | |
| **1** | 0.69 | 0.73 | 0.66 | 0.76 | 0.89 | 0.82 | 0.83 | 0.77 | 0.73 |
| **2** | 0.75 | 0.68 | 0.69 | 0.68 | 0.78 | 0.74 | 0.64 | 0.68 | 0.55 |
| **3** | 0.62 | 0.71 | 0.56 | 0.40 | 0.44 | 0.49 | 0.20 | 0.20 | 0.20 |
| **4** | 0.46 | 0.58 | 0.51 | 0.22 | 0.19 | 0.22 | 0.05 | 0.08 | 0.05 |
| **5** | 0.37 | 0.38 | 0.42 | 0.09 | 0.10 | 0.08 | 0.01 | 0.01 | 0.01 |
| **6** | 0.33 | 0.28 | 0.33 | 0.05 | 0.06 | 0.03 | 0.00 | 0.00 | 0.00 |
| **7** | 0.24 | 0.22 | 0.28 | 0.03 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 |
| **8+** | 0.46 | 0.46 | 0.53 | 0.04 | 0.03 | 0.02 | 0.00 | 0.00 | 0.01 |
| **TFR** | 3.92 | 4.03 | 3.97 | 2.28 | 2.51 | 2.44 | 1.72 | 1.73 | 1.54 |
| **MACi** | | | | | | | | | |
| **1** | 20.9 | 21.3 | 21.5 | 22.2 | 22.4 | 21.9 | 25.1 | 25.3 | 25.4 |
| **2** | 23.0 | 23.5 | 23.9 | 24.8 | 25.3 | 25.1 | 30.2 | 28.5 | 28.7 |
| **3** | 25.2 | 25.6 | 25.4 | 27.5 | 28.1 | 28.3 | 29.9 | 29.8 | 32.0 |
| **4** | 26.6 | 27.3 | 27.4 | 29.7 | 29.9 | 30.5 | 31.1 | 32.2 | 33.9 |
| **5** | 28.6 | 28.0 | 28.9 | 30.6 | 32.4 | 32.2 | 33.4 | 32.5 | 32.6 |
| **6** | 29.8 | 30.9 | 30.5 | 33.4 | 32.6 | 32.7 | - | - | 32.5 |
| **7** | 32.4 | 31.5 | 31.1 | 33.9 | 34.2 | 32.8 | - | - | 0.0 |
| **8+** | 35.5 | 35.4 | 35.0 | 34.5 | 35.9 | 37.2 | - | - | 34.4 |
| **MAC** | 26.6 | 26.8 | 27.2 | 25.6 | 25.8 | 25.7 | 27.8 | 27.4 | 27.8 |

** The values for MAC could not be calculated for the cells marked with (-), due to lack of cases.*

Table 5.1.6 portrays predictable levels of TFR for the three categories of educational attainment. The no education or primary incomplete group has the highest TFR, close to 4 in for all surveys. The first level primary group has a TFR about 0.35 births above replacement level in 2003, and the levels drop under replacement for the secondary level primary or higher group. Although there are very few births in high birth orders, the secondary level primary or higher category has the highest overall mean ages at childbearing. Childbearing is generally completed after third order for this category. The mean ages at first birth differ by an amount of about four years between the least and the most educated category, according to the values of 2003.

**Figure 5.1.28** Birth order-specific total fertility rates for women with no education or who have not completed primary school




The levels for the first two birth orders are not much different from each other according to Figure 5.1.28. A linear decrease is observed afterwards, and the level of births of order 8 and higher is about 0.5. Interestingly, the 2003 values are the highest from fifth birth onwards.

The changes in mean age at childbearing are very small according to survey years (Figure 5.1.29). However, the values for 2003 are slightly higher for the first five birth orders.

**Figure 5.1.29** Birth order-specific mean ages at childbearing for women with no education or who have not completed primary school

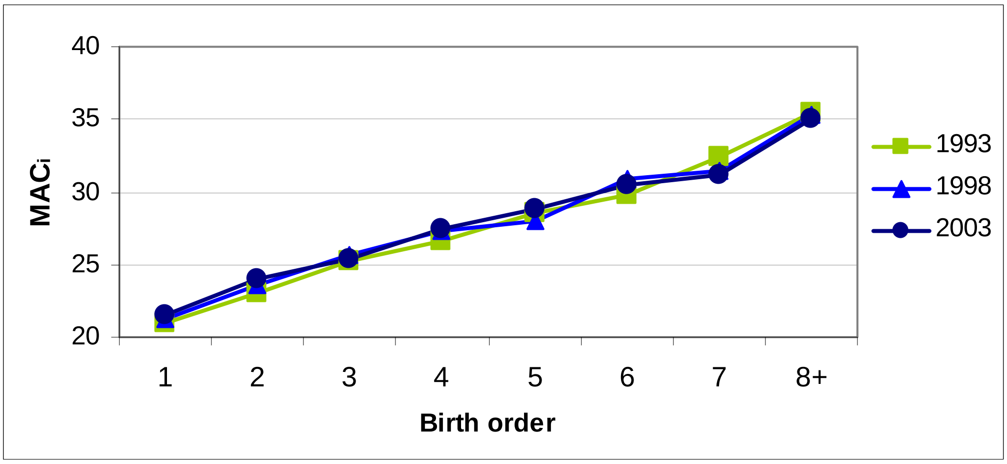
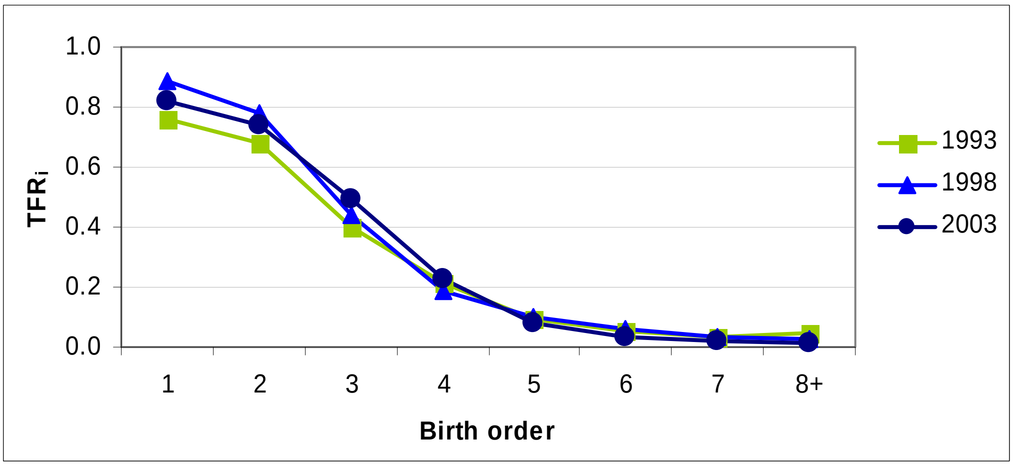



**Figure 5.1.30** Birth order-specific total fertility rates for women who have completed first level primary school




According to Figure 5.1.30, although levels for different years differ until the fourth birth order, they are very close afterwards. The slope of the line between the data points of second birth and third birth is steeper than that of first and second, a faster decrease is observed after second birth. 2003 has lower levels for the first and second birth than 1998, this might suggest a postponement. However, looking at Figure 5.1.31, there does not seem to be a postponement. The mean ages for the first fourth births are very close, and higher birth orders do not show a clear pattern.

**Figure 5.1.31** Birth order-specific mean ages at childbearing for women who have completed first level primary school


**Figure 5.1.32** Birth order-specific total fertility rates for women who have completed second level primary school or higher

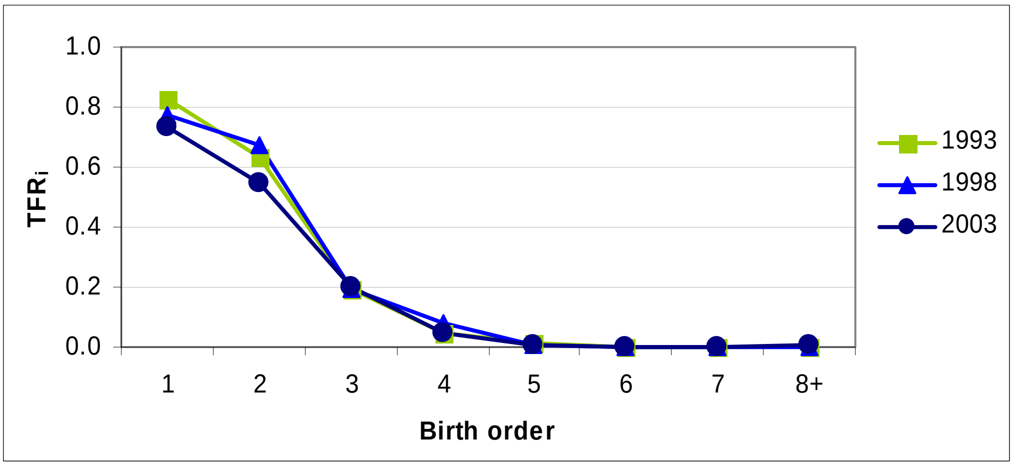
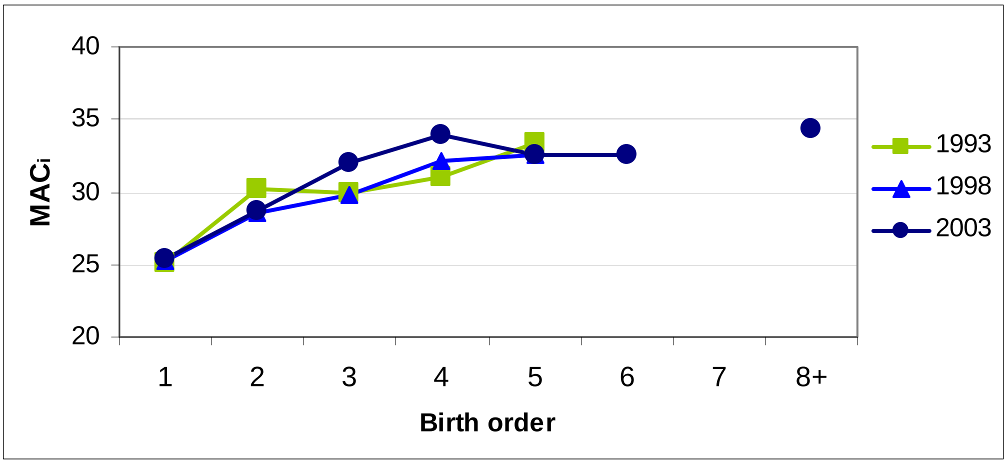



Figure 5.1.32 shows that the obvious characteristic for this group is very low levels of fertility for high birth orders and a large difference exists between the level of second and third birth orders. About 20% of women have their third births, and very few have more. The mean age at first birth is over 25, the highest among all categories for all variables mentioned above. The number of cases is very small after fourth birth, and there are no cases for the empty data points on the graph.

**Figure 5.1.33** Birth order-specific mean ages at childbearing for women who have completed second level primary school or higher



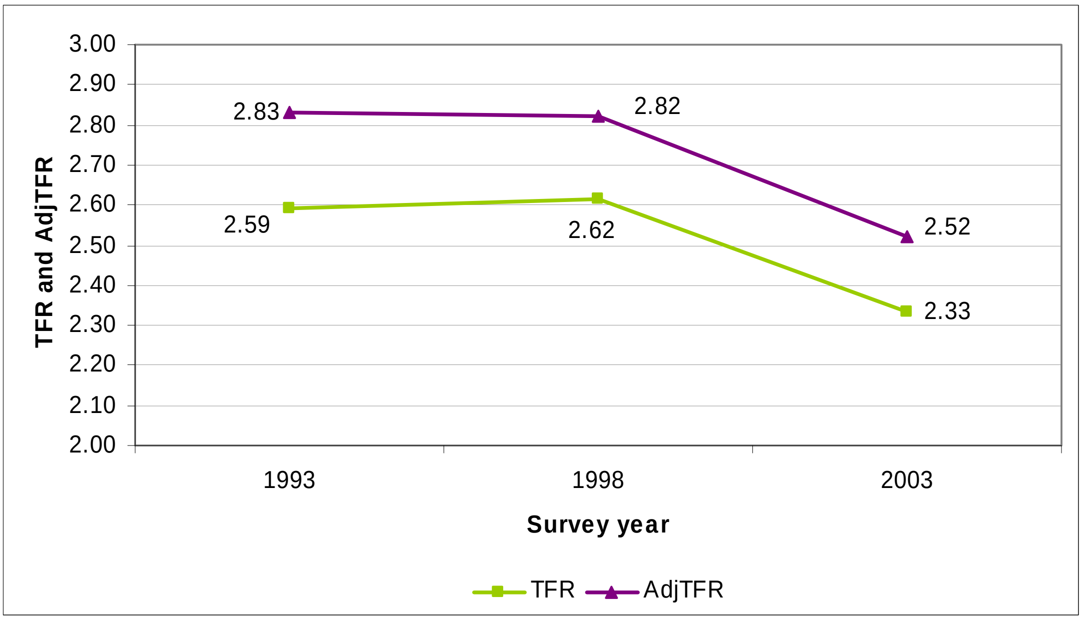

## 5.2 RESULTS FROM THE BONGAARTS AND FEENEY ADJUSTMENT

### 5.2.1 Overall Adjustments for Turkey and Variables

In literature, adjustments on order specific total fertility rates have generally been on either on the first two or first three birth orders. This is only natural, since many of these examples are on European countries, where almost all fertility is completed until fourth birth. In the one example by Bongaarts (1999), mentioned before in Chapter 4.3.1, the adjustment is applied on Colombian survey data, and the first four birth orders are adjusted. Since childbearing extends to high orders of birth especially for some groups of women, it would be better to adjust further birth orders. However, as seen in Chapter 5.1, case numbers may cause problems. The forthcoming section will include examples of unrealistic adjusted $TFR_i$ values for some categories of low case numbers. Thus, as an example, the first seven birth orders will be adjusted for Turkey as a whole, and for calculations in terms of variables, only the first four birth orders will be adjusted following the example of Bongaarts (1999). Table 5.2.1 includes the results for the adjustments of first four birth orders for the sake of comparison.

A point that was mentioned in Chapter 2.4 was the use of time periods for mean age at birth to adjust total fertility rate. The applications on Turkey as a whole show that the annual change in mean age at childbearing is important in determining the pattern of adjusted $TFR_i$. For instance, the figures for 1993, including adjustments made using the approach of Bongaarts (1999) looks alike to the figures for 1998, which include the adjustments made by using the approach by Lesthaeghe and Willems (1999). The same applies for the figures of 1998, resulting from Bongaarts' approach and 2003 from Lesthaeghe and Willems' approach. These pairs of adjustments use the same annual change in mean age at childbearing within. The case of Turkey will be given as an example, for the rest, results for 1993 and 1998 will be given as applied by Bongaarts (1999), and the results for 2003 will be given as applied by Lesthaeghe and Willems (1999). Results for 1998 by using the approach by Lesthaeghe and Willems can be found in Appendix C. Another example that will be given on Turkey only is the approaches in Chapter 2.4.3 that involve the adjustment of a single survey by using data from the corresponding survey only. This example can be found in Appendix D.

**Figure 5.2.1.1** Total Fertility Rate, Adjusted Total Fertility Rate* and Mean Age at Childbearing, 1993, 1998** and 2003




* The adjustments are applied on the first four birth orders.

** The adjustment for 1998 is made according to the approach of Bongaarts (1999).

Figure 5.2.1.1 shows the same plot in Figure 5.1.1 with the addition of the series of adjusted TFR. The tempo effects for the TFR of 1993, 1998 and 2003 are -0.24, -0.20 and -0.19 respectively. Thus the largest postponement is observed for 1993, a result that can be expected considering the rapid decrease in TFR from 1988 TPHS to 1993 TDHS. A smoother decrease is obtained after the adjustment. While the TFR of 1998 is higher than that of 1993, the adjusted values show the opposite, although the changes are very small.

The size of tempo effects are not very large or not very small compared results previously obtained in literature. Table 4.3.2.2 in Chapter 4, for example, gives tempo effects for European countries within a range of [-0.08, -0.55].

TABLE 5.2.1.1

Table 5.2.1.1 above shows the total fertility rates, adjusted total fertility rates and tempo effects for all variables for the three surveys. For 1993, Kurdish mother tongue group has the largest absolute tempo effect among all categories. For 1998, the other languages category has this property, and this applies for 2003 as well.

The tempo effects for urban and rural types of residences are not very different, the largest difference is 0.04 for 1993. In terms of regions, northern and central regions seem to have the largest tempo effects. While the tempo effects for 1998 and 2003 are close, the values for 1993 are more diverse. A similar situation is observed for migration categories. Additionally, postponement seems to be more common for urban natives than rural natives. Rural to urban migrants seem to have the smallest changes in timing.

Tempo effects for Turkish mother tongue group have very close values for the three surveys, while interesting results are obtained for Kurdish and other mother tongue groups: For the Kurdish mother tongue group, a negative tempo effect of 0.62 is found for 1993, while positive tempo effects of 0.05 and 0.04 are calculated for 1998 and 2003 respectively. Thus, while 1993 suggests postponement for Kurdish speaking women, 1998 and 2003 suggest very small advances in childbearing. The opposite is observed for the other mother tongue groups. A positive tempo effect of 0.22 is observed for 1993, while negative tempo effects around 0.7 are observed for 1998 and 2003. Among educational attainment categories, women who have completed first level primary school have the smallest tempo effects. The largest ones are those of women who have completed second level primary school or have higher education.

### 5.2.2 Order Specific Adjustments for Turkey and Variables

According to Figure 5.2.2.1, generally the first four births are affected by the adjustment. The adjusted values are about 0.05 higher than regular ones. The adjusted value may be more realistic in this case, since it increases a $TFR_1$ that is lower than 0.8. Overall, TFR is adjusted from 2.59 to 2.83.

**Figure 5.2.2.1** TFR and Adjusted TFR for first seven birth orders, Turkey, 1993

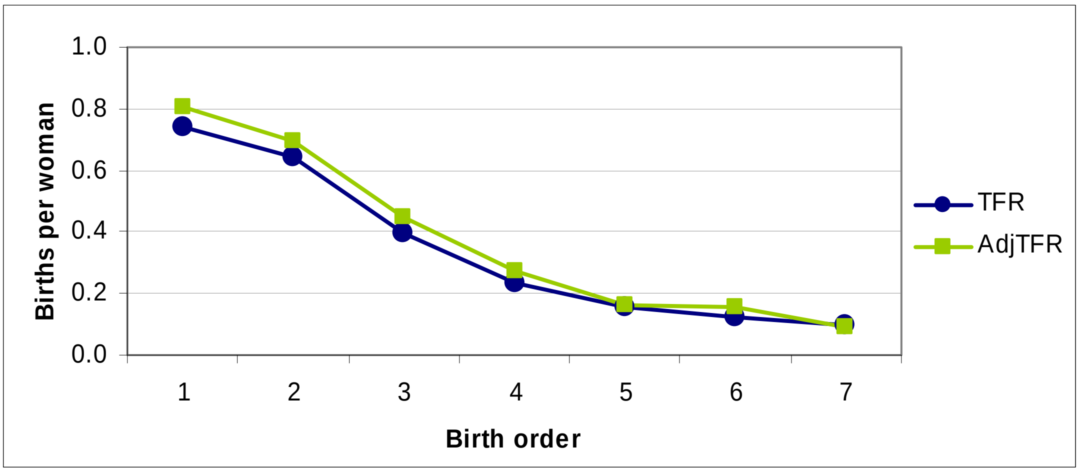



**Figure 5.2.2.2** TFR and Adjusted TFR for first seven birth orders, Turkey, 1998, using the approach of Bongaarts (1999)

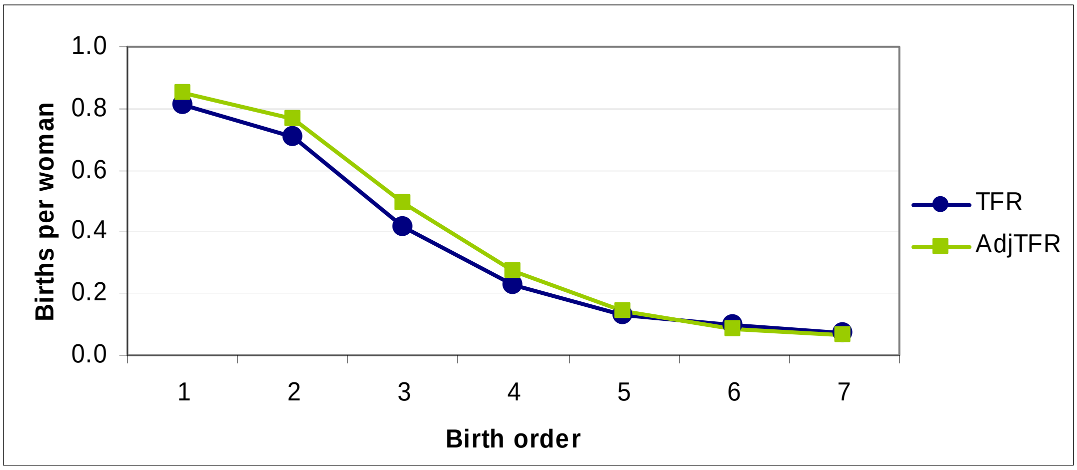



Figure 5.2.2.2 has a common property with Figure 5.2.2.1; adjustment seems to change the values of the first four birth orders. Third birth seems to be

postponed more. The overall TFR value is 2.62 for 1998, and the adjusted value is 2.82.

Figure 5.2.2.3 also shows an adjustment to 1998, the first four birth orders cause most of the change again. The difference between adjusted and regular TFR values is greatest for order 1, and smaller for the following three orders. The overall adjusted TFR value is 2.86.

**Figure 5.2.2.3** TFR and Adjusted TFR for first seven birth orders, Turkey, 1998, using the approach of Lesthaeghe and Willems (1999)

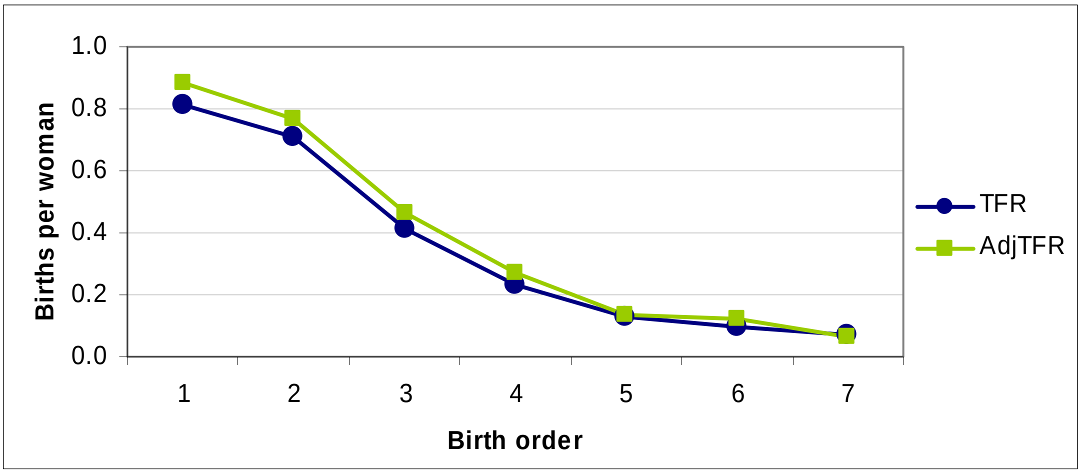
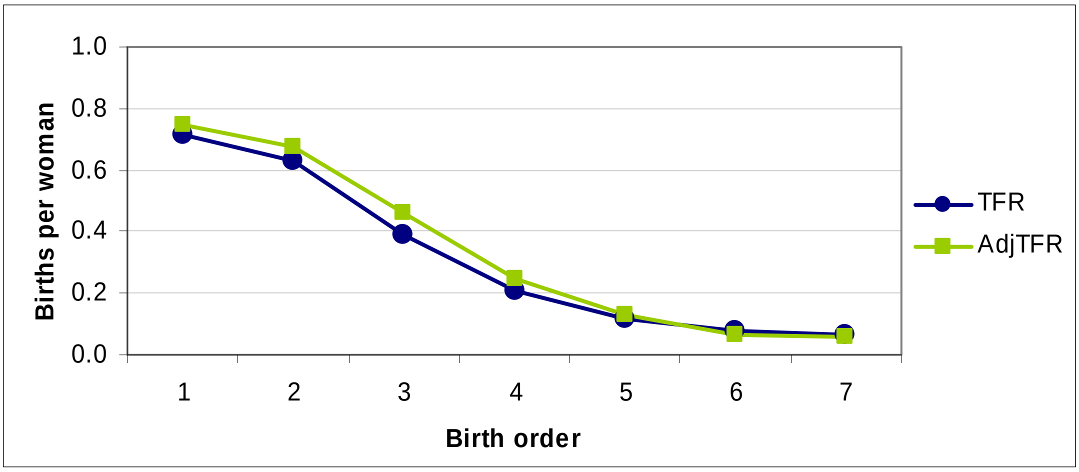


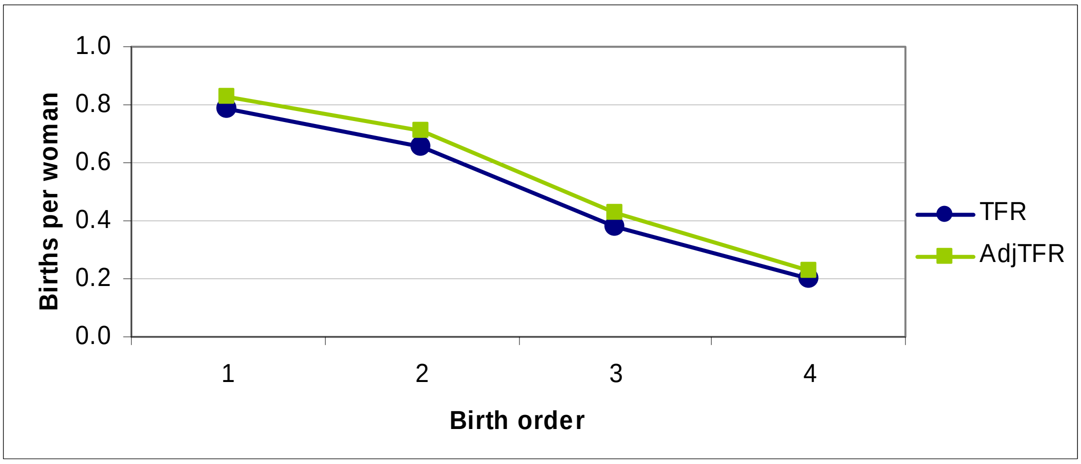
Figure 5.2.2.4 shares the common characteristic of small changes after fourth birth between regular and adjusted TFR values. The difference between TFR and adjusted TFR is highest for third birth, and is relatively small for first birth.

**Figure 5.2.2.4** TFR and Adjusted TFR for first seven birth orders, Turkey, 2003



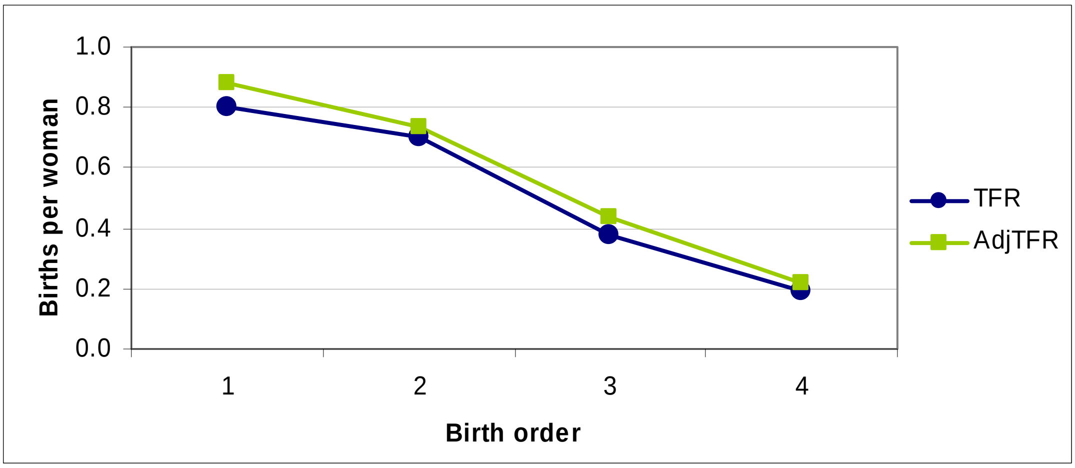

The below figures show the adjustments of the first four $TFR_i$ values in terms of variables. It can be observed that the series for $TFR_i$ and adjusted $TFR_i$ are generally closer to each other for categories with a relatively high number of cases. Figure 5.2.2.5, 5.2.2.6 and 5.2.2.7 below show the adjustments for urban residences for the three survey years. For 1993, $TFR_1$ and $TFR_4$ have not changed as much as second or third $TFR_i$. The overall tempo effect is found to be -0.18.

**Figure 5.2.2.5** TFR and Adjusted TFR for first four birth orders, Urban, 1993



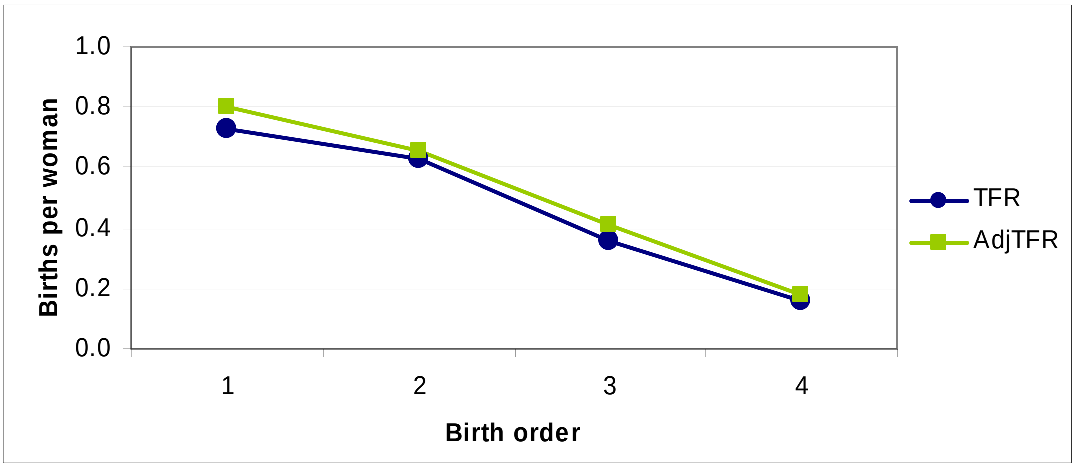
The figure for 1998 shows larger differences for first and third $TFR_i$. The adjusted series has a more linear shape. The overall tempo effect is -0.20, 0.08 of which is due to first birth (Appendix C).

**Figure 5.2.2.6** TFR and Adjusted TFR for first four birth orders, Urban, 1998



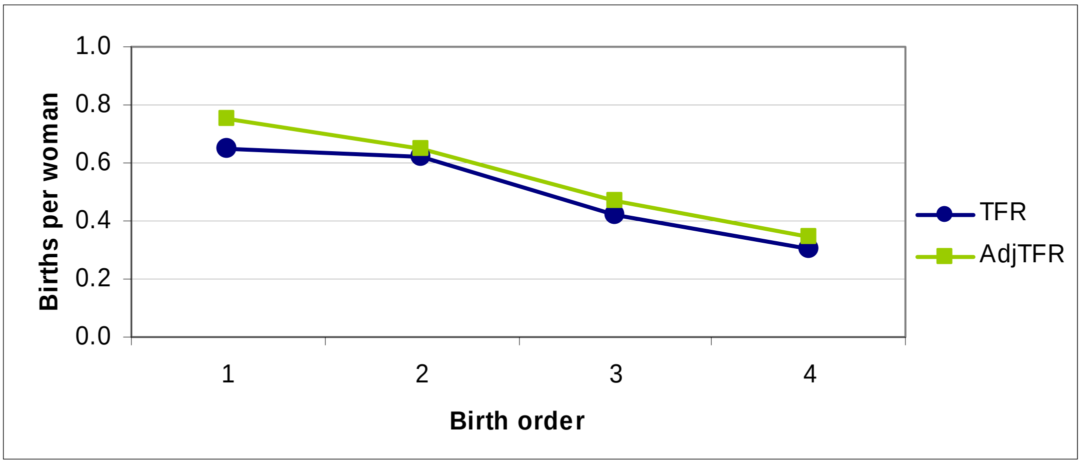

The shape of the plot in Figure 5.2.2.7 looks similar to the shape in Figure 5.2.2.6, although the levels of $TFR_i$ are lower for 2003. The similarity in shape is likely to be common for the forthcoming categories as well, due to reasons discusses previously in this section. The largest tempo is observed for the first birth for 2003 as well, with a value of 0.07. The overall TFR value of 2.13 for urban residences in 2003 reach a value of 2.31 when adjusted.

**Figure 5.2.2.7** TFR and Adjusted TFR for first four birth orders, Urban, 2003




The below three figures are for rural residences. Figure 5.2.2.8 shows a relatively high tempo effect for first birth. It accounts for about 45% for the tempo effects caused by all four birth orders.

**Figure 5.2.2.8** TFR and Adjusted TFR for first four birth orders, Rural, 1993




For Figure 5.2.2.8, the adjustment gives $TFR_i$ a more linear shape. Small differences exist between the adjusted and regular $TFR_i$ for birth orders 2-4. The adjusted TFR is 0.19 higher than regular TFR.

Figure 5.2.2.9 and Figure 5.2.2.10 show an interesting pattern, the adjusted $TFR_1$ is lower than the regular $TFR_1$. This means births have been advanced between

1998 and 2003. Table 5.1.2 before showed the MAC $_1$ value as 22.8 for 1998, and a value 0.5 years smaller for 2003. The differences between the regular and adjusted TFR values for birth order 2-4 are also larger compared to these in Figure 5.2.2.8. The tempo effect for TFR of 1998 is found to be 0.18, although this would have been higher were absolute differences used.

**Figure 5.2.2.9** TFR and Adjusted TFR for first four birth orders, Rural, 1998

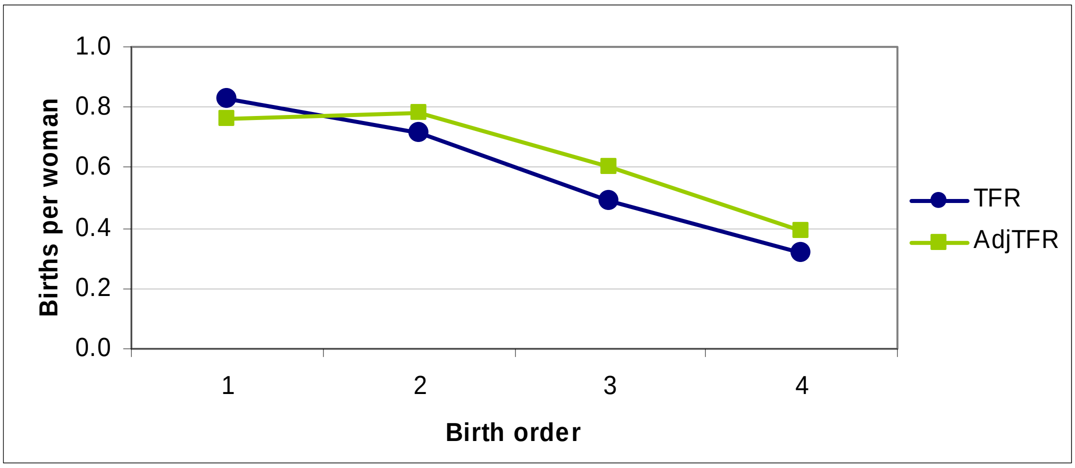
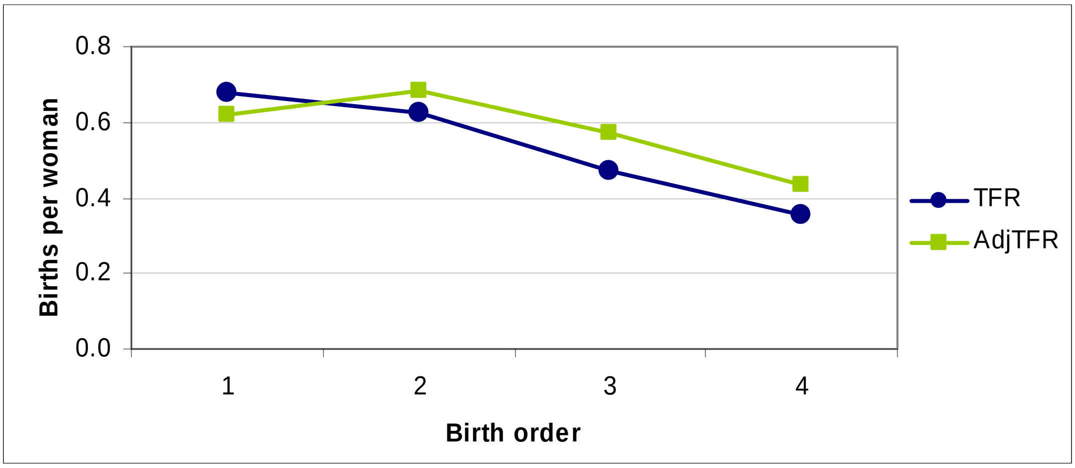
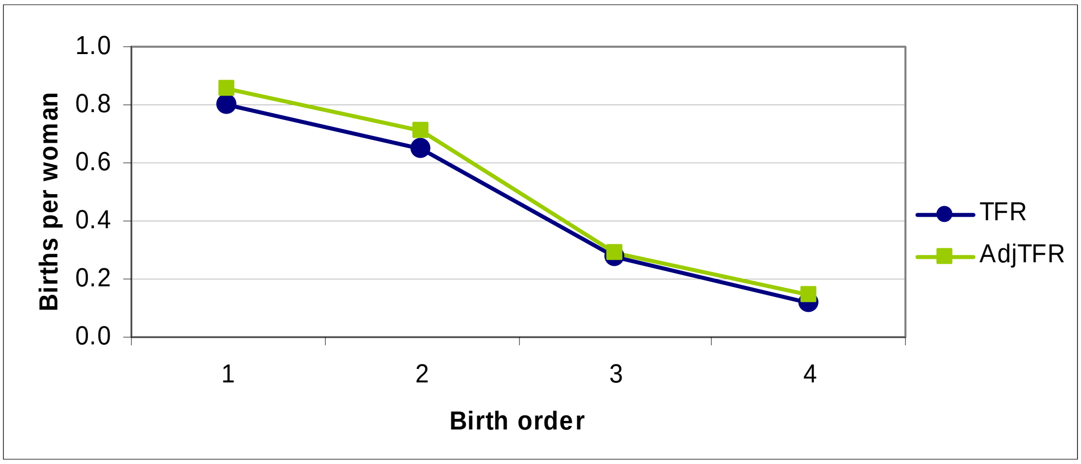



**Figure 5.2.2.10** TFR and Adjusted TFR for first four birth orders, Rural, 2003



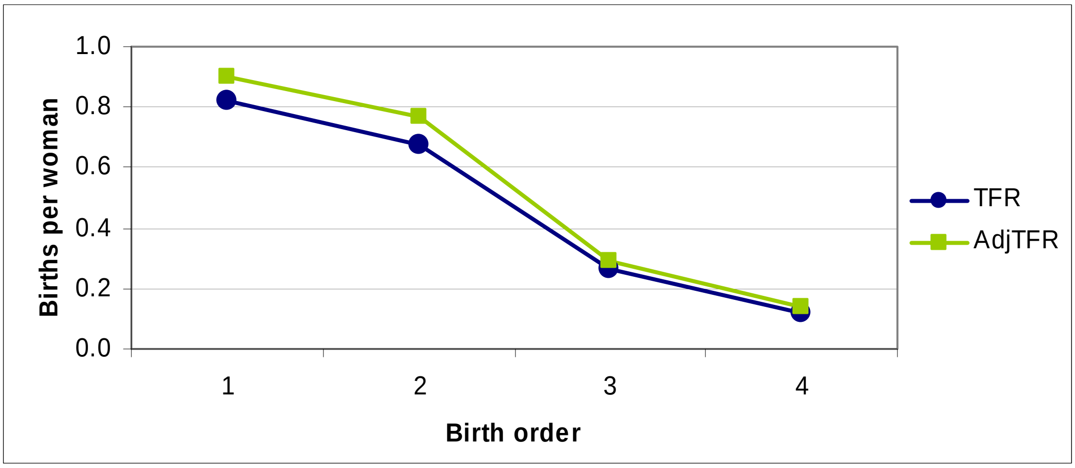
The following fifteen figures present the results for the five regions. The plot for western region, 1993 (Figure 5.2.2.11) shows small differences between two TFR measures. The first two births are relatively more postponed. The adjusted $TFR_i$ series has a similar shape to that of regular $TFR_i$.

**Figure 5.2.2.11** TFR and Adjusted TFR for first four birth orders, west, 1993



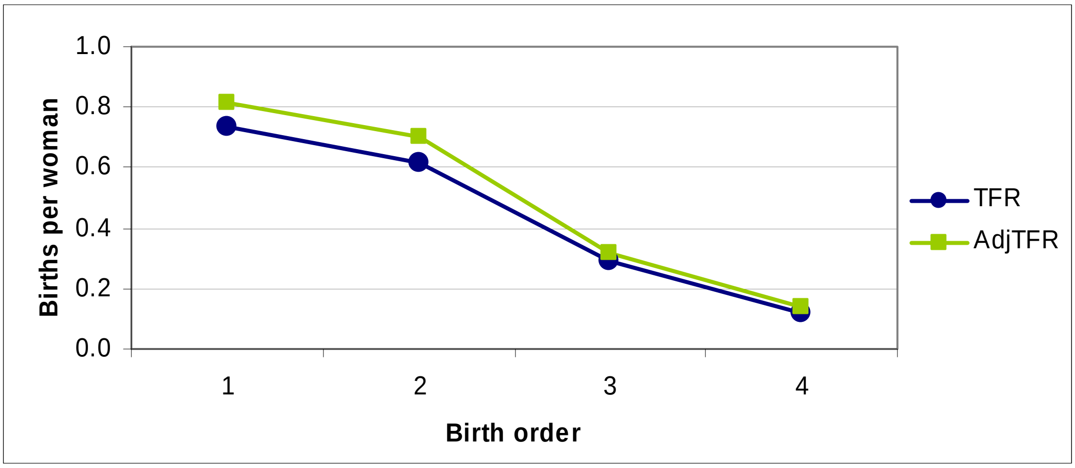

The three figures for western region are similar in shape. A steeper decline is seen after second birth for both $TFR_i$ and adjusted $TFR_i$. This shape is less obvious in Figure 5.2.2.13, since the first two $TFR_i$ are lower in level.

**Figure 5.2.2.12** TFR and Adjusted TFR for first four birth orders, west, 1998



The adjusted TFR series are parallel in Figures 5.2.2.12 and 5.2.2.13: Small changes for third and fourth birth orders, and rather larger changes for the first two births. While the adjusted TFR is 2.25 for 1998, it reaches replacement in 2003 (Table 5.2.1.1).

**Figure 5.2.2.13** TFR and Adjusted TFR for first four birth orders, west, 2003




As mentioned before, the adjustments for categories with relatively small number of cases may yield in misleading results. The plots show that the more different the shapes of the distributions of $TFR_i$ from each other according to survey years, the more misleading the results. The first figure for northern region presents a reasonable value for the adjusted value, a $TFR_1$ that is close to 1, and the level linearly decreases for the rest of the birth orders.

**Figure 5.2.2.14** TFR and Adjusted TFR for first four birth orders, north, 1993

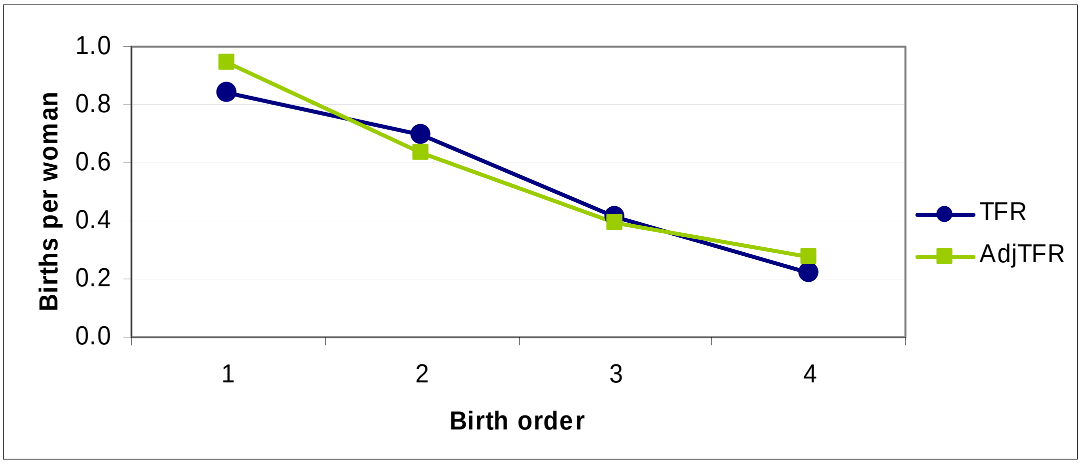



Figure 5.2.2.15 increases the level of second and third birth orders under adjustment, however, $TFR_3$ is higher than expected, about 0.7, meaning 70% of women have a third child in northern region, which is very unlikely.

**Figure 5.2.2.15** TFR and Adjusted TFR for first four birth orders, North, 1998

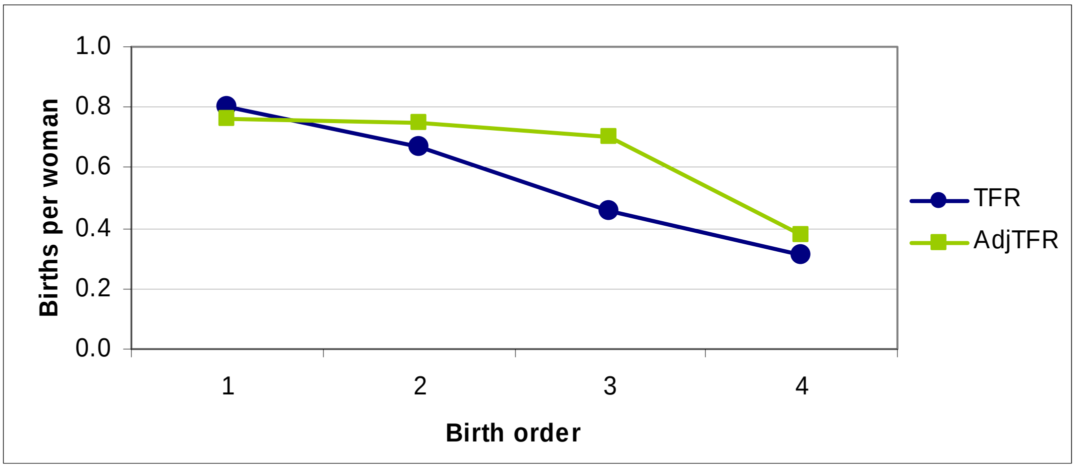
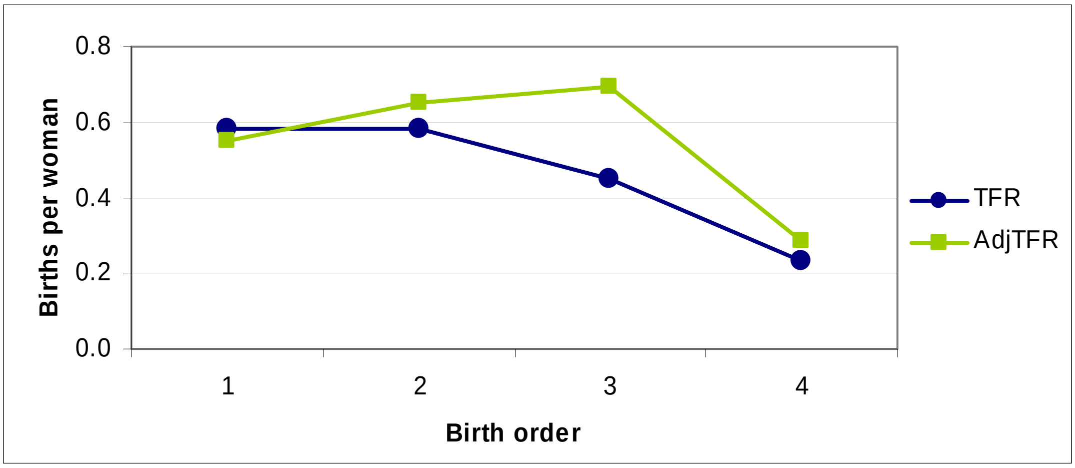



Figure 5.2.2.16 shows the adjustments for 2003. The shape of the series in this figure suggests that the highest level of $TFR_i$ exists for third birth, and lower levels exist for second and third birth, which is unexpected.

**Figure 5.2.2.16** TFR and Adjusted TFR for first four birth orders, North, 2003




Central region portrays more reasonable adjusted $TFR_i$ compared to northern region. Figure 5.2.2.17 shows slightly higher adjusted $TFR_i$ for first, third and fourth birth orders, and a 0.12 higher adjusted $TFR_2$. The overall adjusted TFR reaches 2.77 from a TFR of 2.51. One interesting difference between the figure for 1993 and the other years is that the adjusted series increases the difference between the levels of second and third birth for 1993, and does the opposite for 1998 and 2003.

**Figure 5.2.2.17** TFR and Adjusted TFR for first four birth orders, Central, 1993

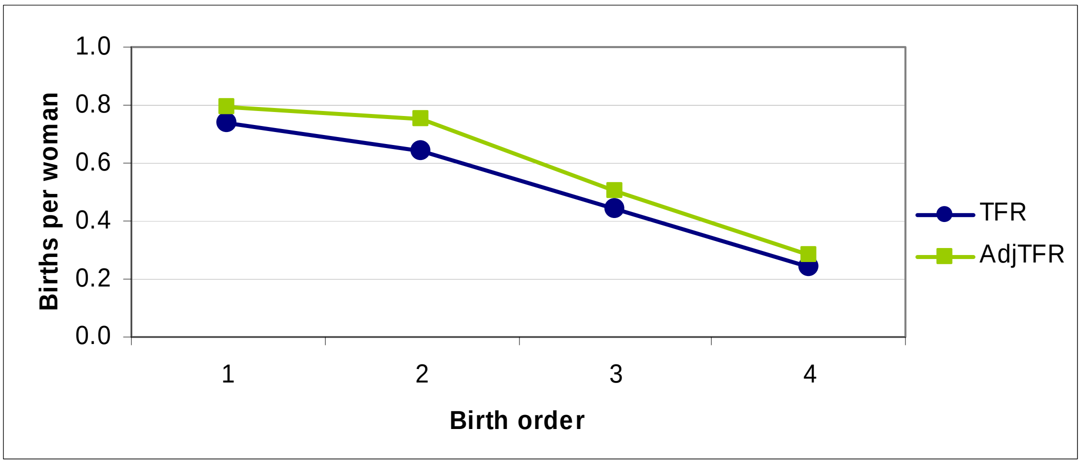
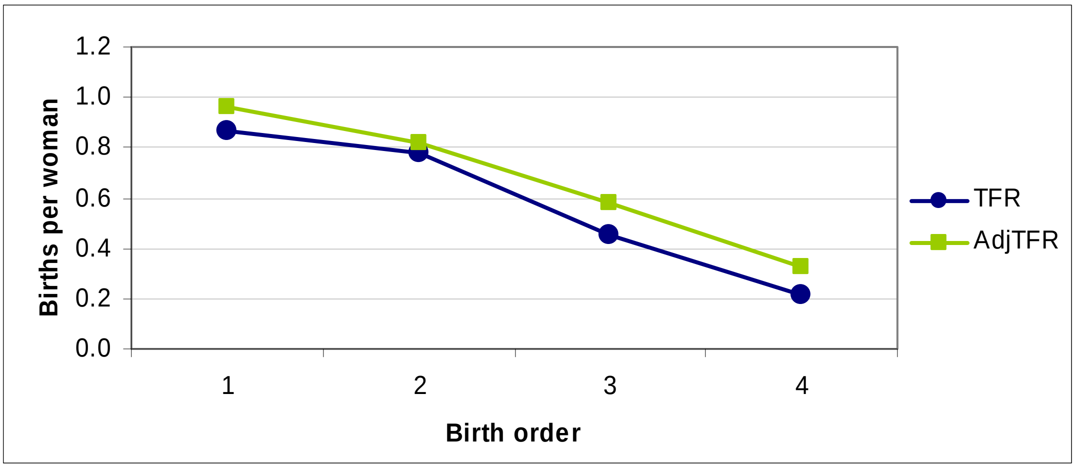


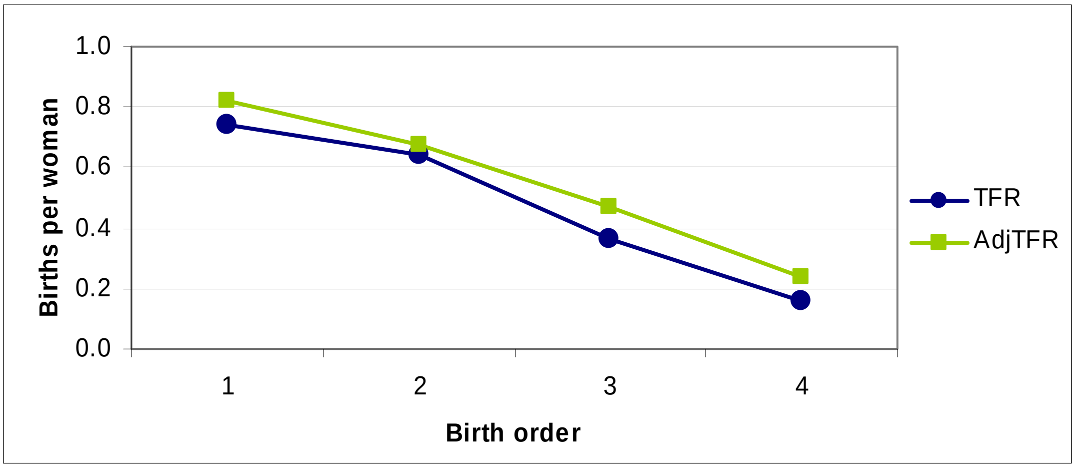
Figure 5.2.2.18 and Figure 5.2.2.19 show very similar shapes for both regular and adjusted $TFR_i$ series. The figures differ mostly in level, the adjusted $TFR_1$ has a value close to one in 1998 and a value of about 0.8 for 2003.

**Figure 5.2.2.18** TFR and Adjusted TFR for first four birth orders, Central, 1998




The differences between adjusted and regular values are slightly higher in 1998 than 2003, the tempo effects are -0.37 and -0.29 respectively.

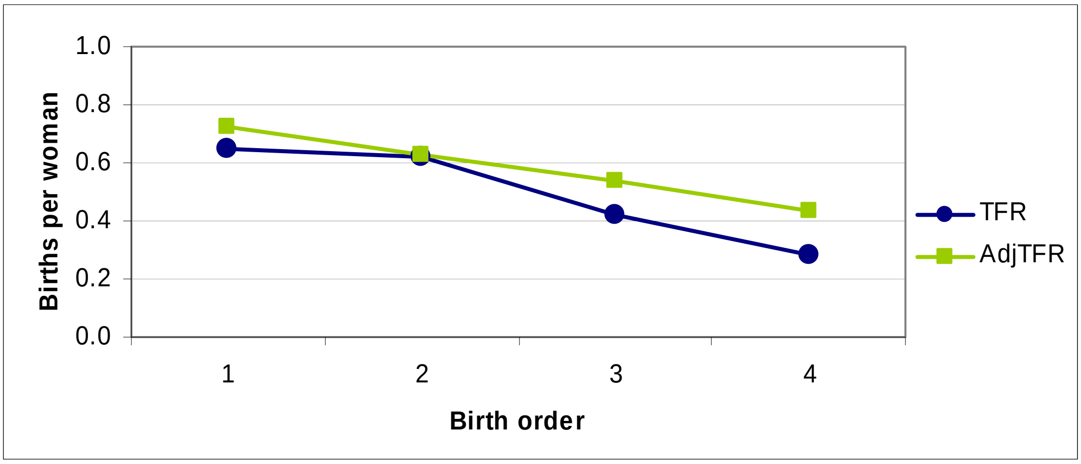
**Figure 5.2.2.19** TFR and Adjusted TFR for first four birth orders Central, 2003




Similar to central region, the adjusted series of 1993 and others are different in shape for southern region. The adjusted $TFR_i$ series in Figure 5.2.2.20 has a linear shape, and the tempo effects for third and fourth births are especially large, -0.12 and -0.15 respectively (Appendix C). Figure 5.2.2.21 shows the highest level of $TFR_1$

and adjusted $TFR_1$. The adjusted $TFR_1$ values are slightly lower than regular $TFR_1$ values for both Figures 5.2.2.21 and 5.2.2.22.

**Figure 5.2.2.20** TFR and Adjusted TFR for first four birth orders, South, 1993




Another common point in Figure 5.2.21 and 5.2.22 is the relatively higher tempo effects in third birth. The overall adjusted TFR values are 2.75 and 2.46 for 1998 and 2003 respectively.

**Figure 5.2.2.21** TFR and Adjusted TFR for first four birth orders, South, 1998

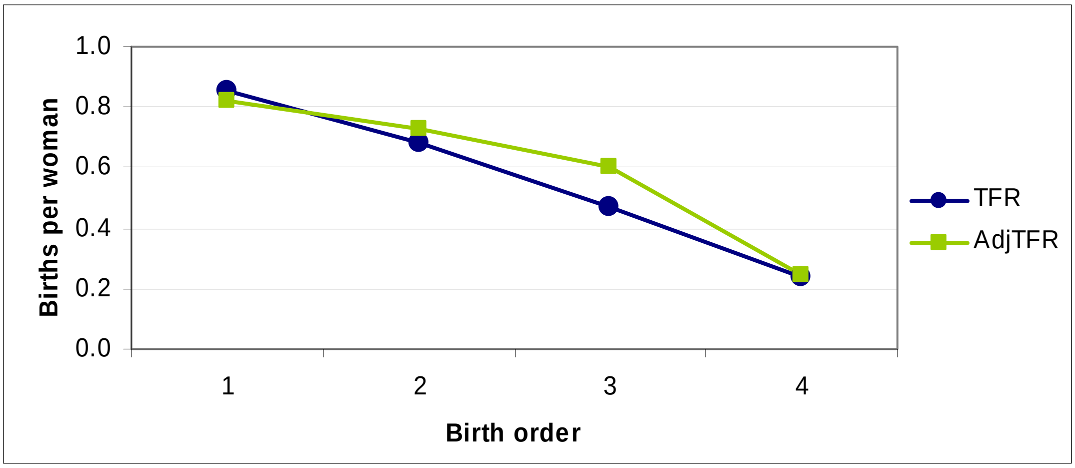
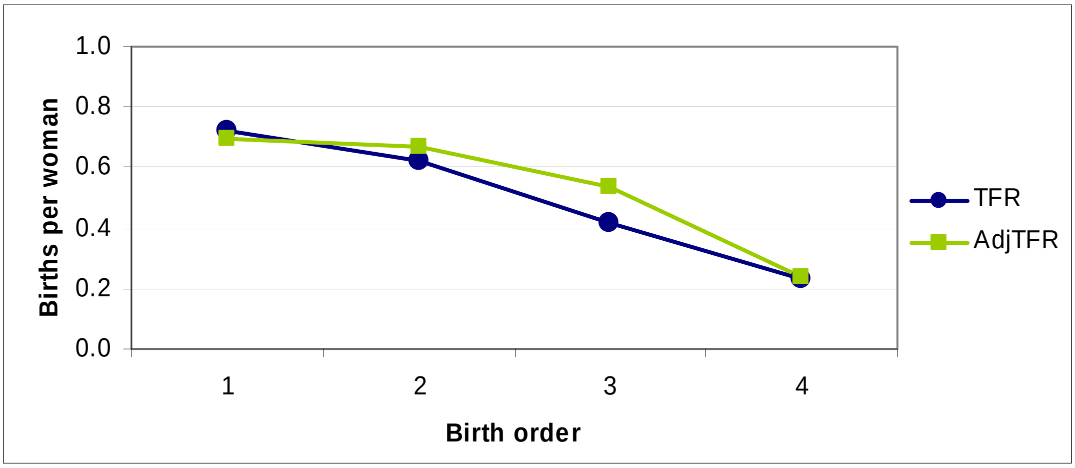


**Figure 5.2.2.22** TFR and Adjusted TFR for first four birth orders, South, 2003




All three figures for eastern region show low levels of first birth, especially low for the region with the highest level of fertility. The adjustment for 1993 (Figure 5.2.2.23) emphasizes postponements in first and third birth. However, the adjusted series has a $TFR_i$ value for third birth that is higher than second birth, which is suspicious. An overall tempo effect of -0.27 is calculated for 1993.

**Figure 5.2.2.23** TFR and Adjusted TFR for first four birth orders, East, 1993

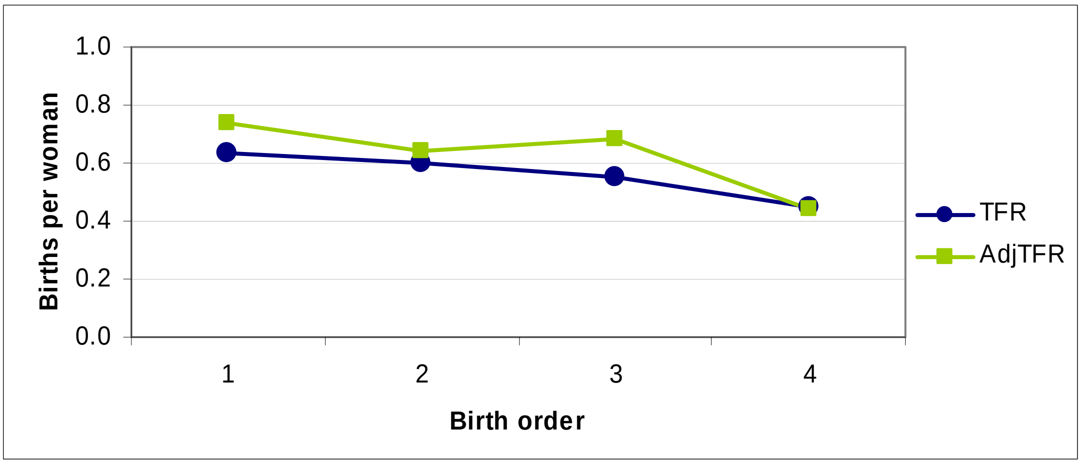
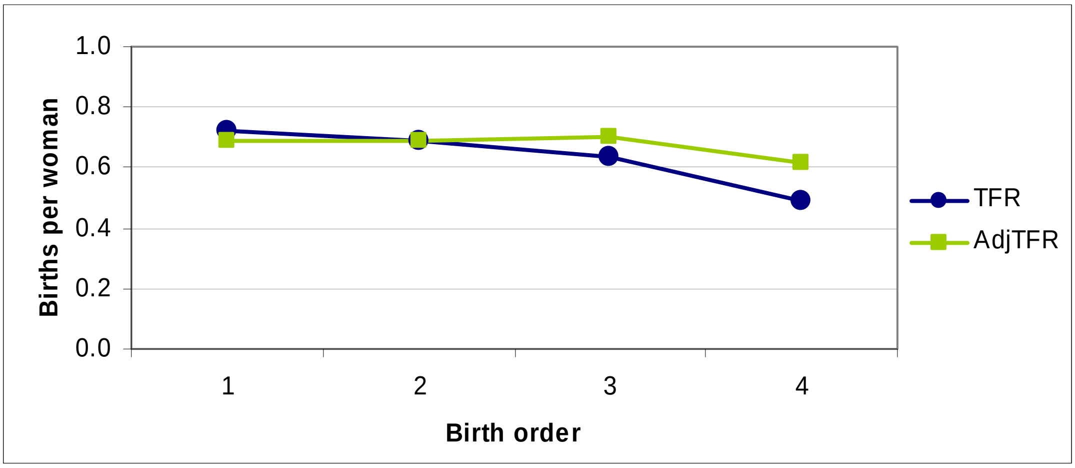
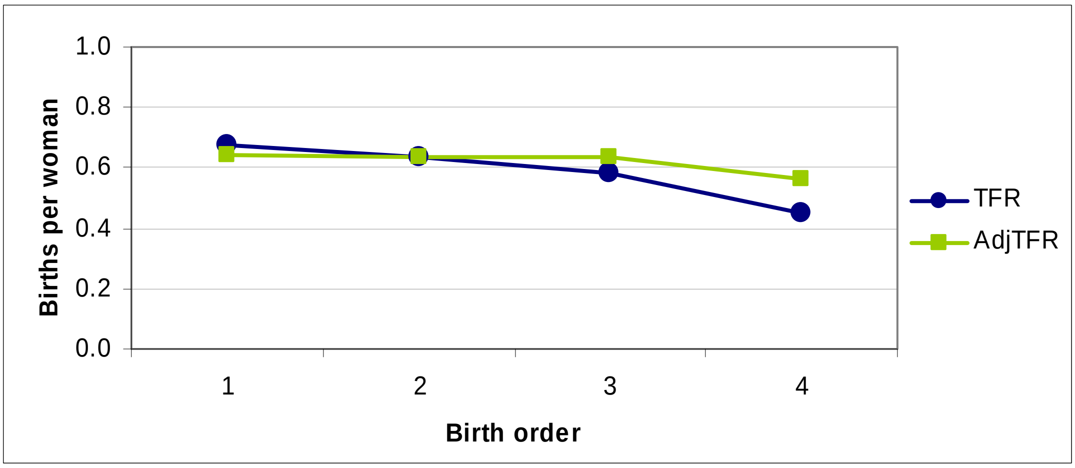


**Figure 5.2.2.24 TFR** and Adjusted TFR for first four birth orders, East, 1998



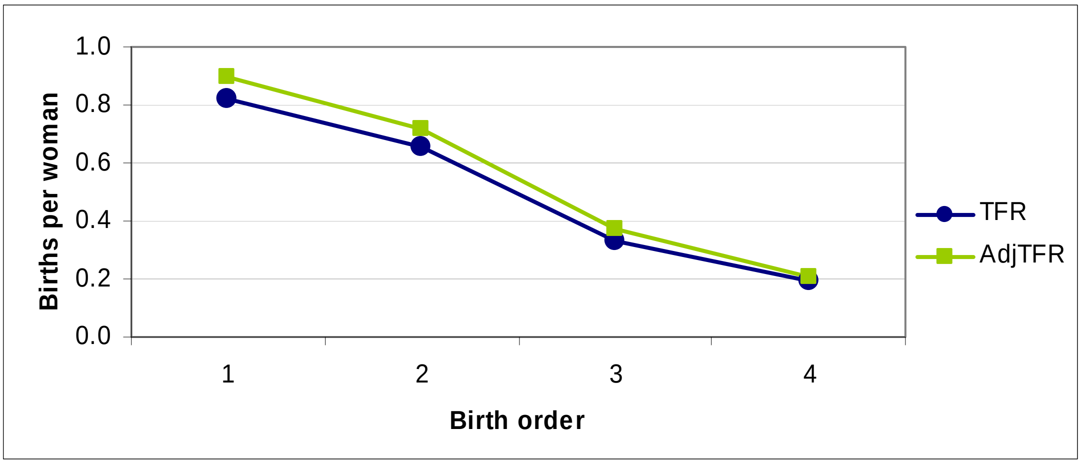

The mean age at first birth for eastern region has decreased from 22.6 to 22.4 from 1998 to 2003 (Table 5.1.3). Thus Figures 5.2.2.25 and 5.2.2.26 show advances in first birth. The adjusted series in both figures have low levels of first birth compared to second birth. The level of $TFR_i$ in for 2003 is especially low for first birth. The adjusted $TFR_1$ is 0.64.

**Figure 5.2.2.25** TFR and Adjusted TFR for first four birth orders, East, 2003




The following twelve figures are on migration categories. Figure 5.2.2.26 shows an increase of 0.08 for first birth after adjustment, and this difference decreases to 0.02 for fourth birth. The shape of the adjusted series is close to that of the regular $TFR_i$ series.

**Figure 5.2.2.26** TFR and Adjusted TFR for first four birth orders, Urban native women, 1993




Figures 5.2.2.27 and 5.2.2.28 show similar patterns, the adjustment pulls the level of third birth higher, eliminating the shape suggested by the regular $TFR_i$ that there is a steep decline after second birth. This decline is expected for urban native women, since they have the lowest level of fertility among migration categories, and it is under replacement since 1998. Figure 5.2.2.28 has generally lower levels of $TFR_i$ and adjusted $TFR_i$. The adjusted overall TFR value for 1998 is 2.50, pulling the level above replacement, and 2.12 for 2003.

**Figure 5.2.2.27** TFR and Adjusted TFR for first four birth orders, Urban native women, 1998

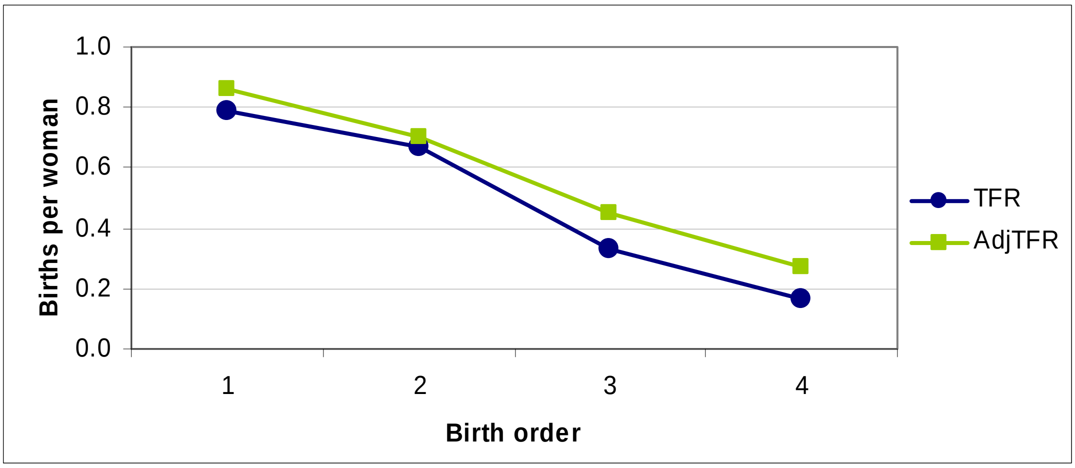
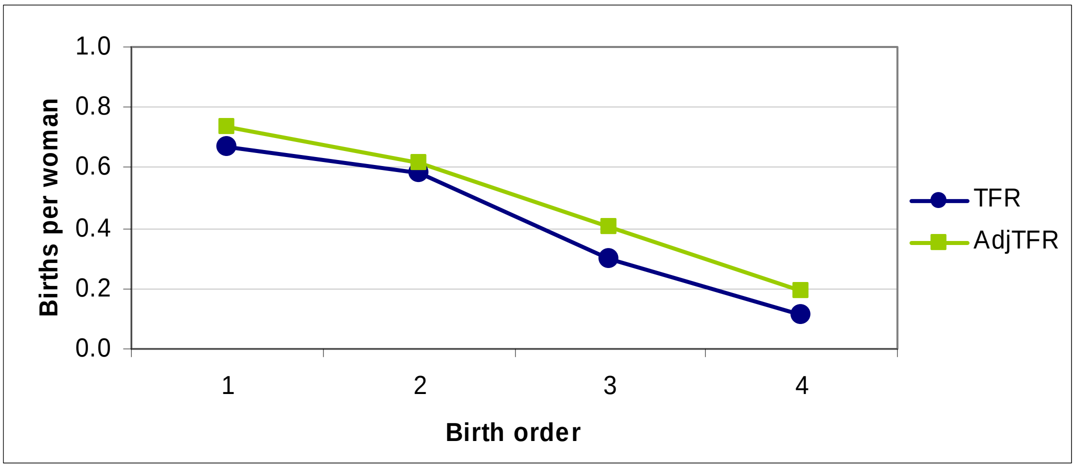


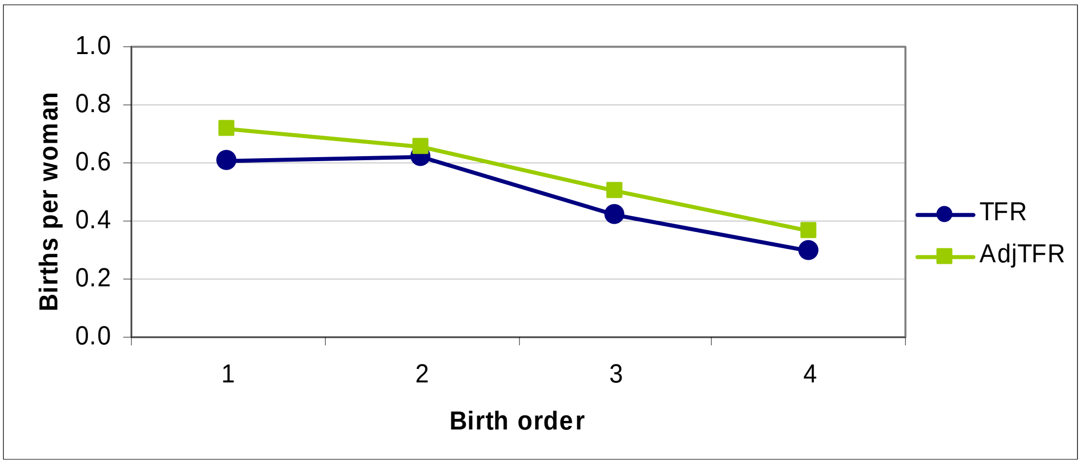

**Figure 5.2.2.28** TFR and Adjusted TFR for first four birth orders, Urban native women, 2003




As mentioned before, the number of cases for urban to rural migrants is relatively low, thus the resulting figures may be misleading, and are given in Appendix B.

For rural native women, the overall adjusted TFR values are higher than conventional TFR. For 1993 (Figure 5.2.2.29), a tempo effect of -0.12 is found for first birth (Appendix C), pulling the value of $TFR_1$ up to 0.72. The adjusted series has a more linear shape.

**Figure 5.2.2.29** TFR and Adjusted TFR for first four birth orders, Rural native women, 1993




Figures 5.2.2.30 and 5.2.2.31 show lower adjusted $TFR_1$ than $TFR_1$. According to Table 2.1.4, mean age at first birth has fallen from 22.7 to 22.3 from 1998 to 2003, resulting in the figures below. The level of second birth increases in both figures, reaching almost 0.8 in 1998 and 0.7 in 2003. The overall TFR increases by 0.19 for both years.

**Figure 5.2.2.30** TFR and Adjusted TFR for first four birth orders, Rural native women, 1998

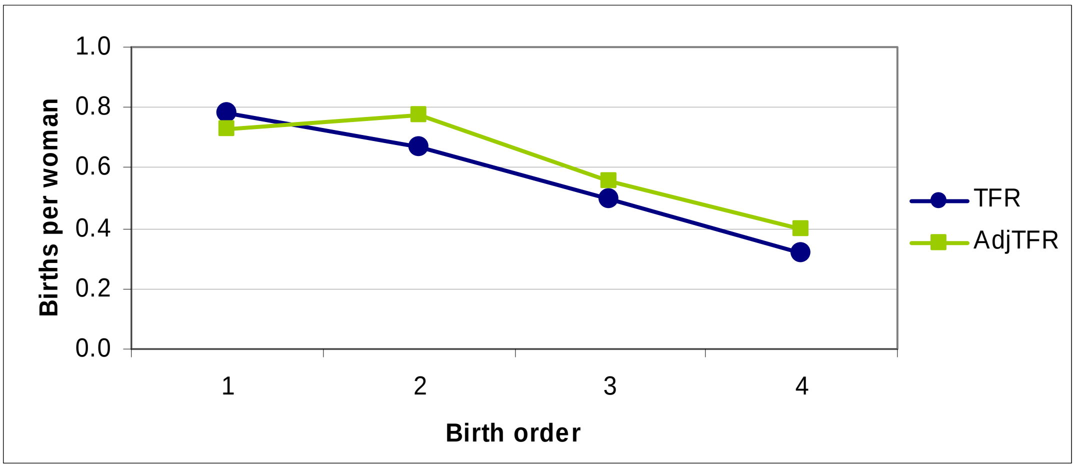
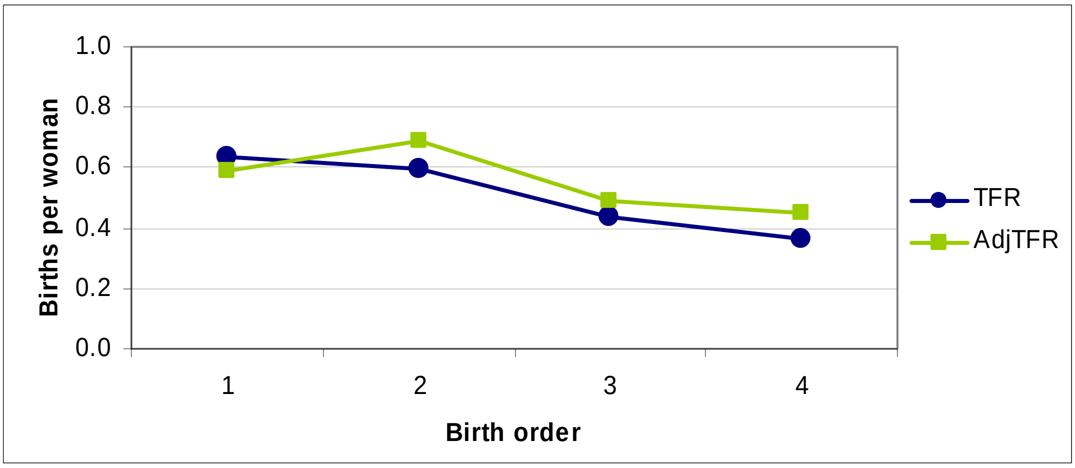


**Figure 5.2.2.31** TFR and Adjusted TFR for first four birth orders, Rural native women, 2003




The adjusted $TFR_i$ values differ slightly from regular $TFR_1$ values for rural to urban migrants. Close differences exist between $TFR_i$ and adjusted $TFR_i$ for first and second birth for 1993 (Figure 5.2.2.32): 0.6 for both (Appendix C). Overall adjusted TFR is 0.14 lower than regular TFR. For 1998 and 2003, the levels of adjusted $TFR_i$ are higher than regular $TFR_i$, but slightly again (Figure 5.2.2.33 and Figure 5.2.2.34). By both figures, it is suggested that the first three births are postponed. The overall tempo effect for 1998 and 2003 are -0.12 and -0.11 respectively.

**Figure 5.2.2.32** TFR and Adjusted TFR for first four birth orders, Rural to urban migrants, 1993

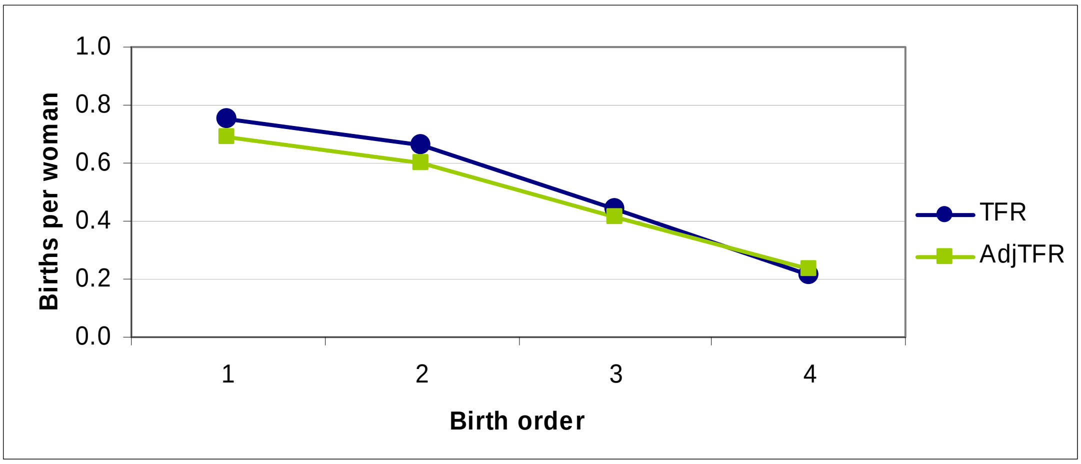
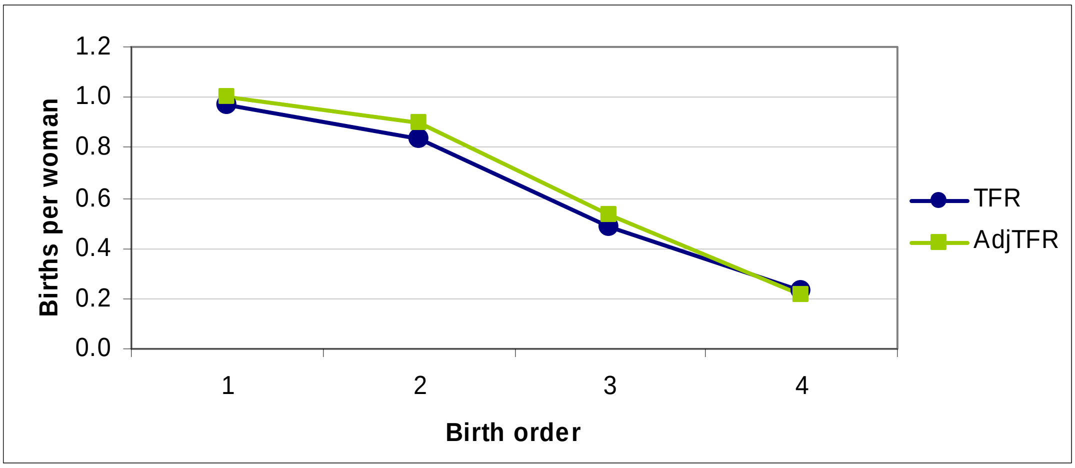
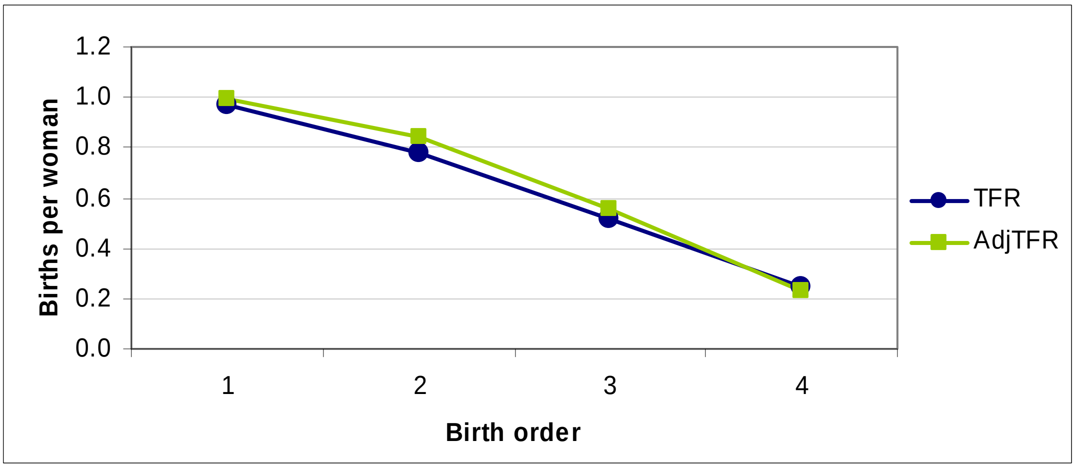


**Figure 5.2.2.33** TFR and Adjusted TFR for first four birth orders, Rural to urban migrants, 1998



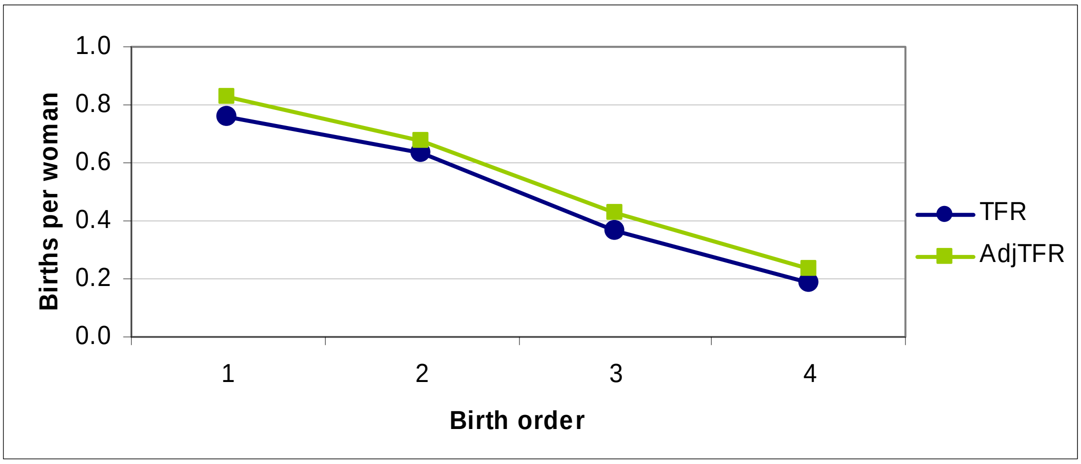

An interesting characteristic for Figure 5.2.2.34 and 5.2.2.35 is that the level of $TFR_1$ is very close to 1. Although expected, this was not observed often in the previous figures.

**Figure 5.2.2.34** TFR and Adjusted TFR for first four birth orders, Rural to urban migrants, 2003



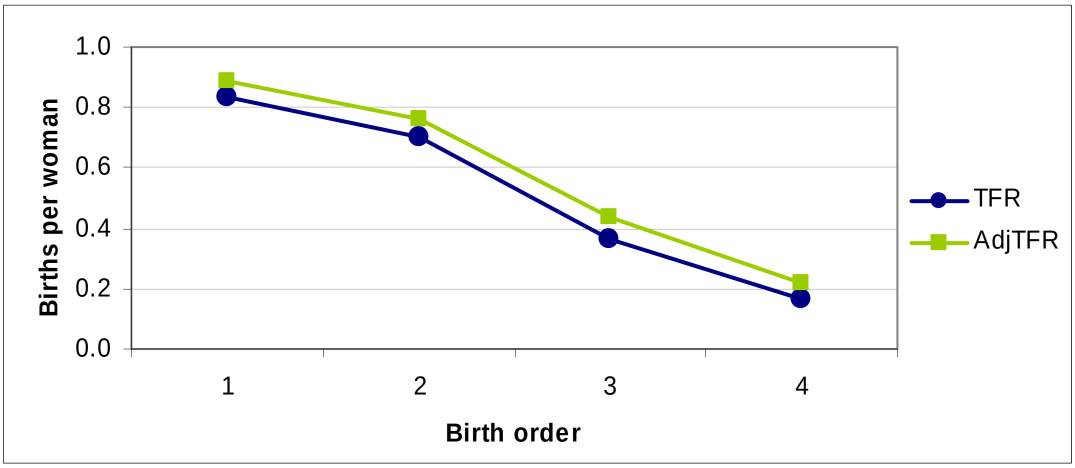

Among mother tongue groups, the adjustments for women whose mother tongue is Turkish have the smallest differences from regular $TFR_i$. The adjustments for 1993 bring the level of $TFR_1$ from 0.76 to 0.83 (Appendix C). With the addition of other birth orders, the overall tempo effect is found as -0.21.

**Figure 5.2.2.35** TFR and Adjusted TFR for first four birth orders, Turkish mother tongue group, 1993



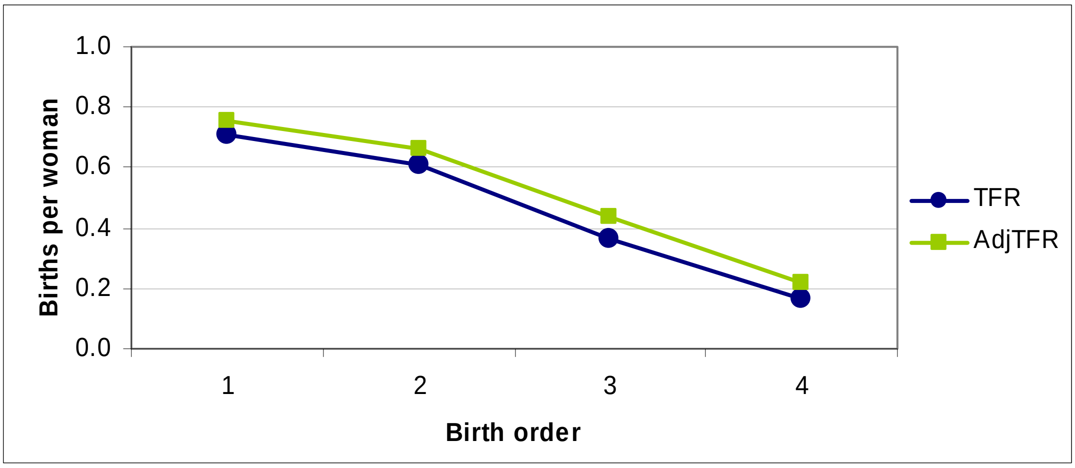

The series of adjusted $TFR_i$ are almost parallel to those of regular $TFR_i$ for 1998 and 2003, suggesting even postponements for all birth orders (Figure 5.2.2.36 and Figure 5.2.2.37). The tempo effects of birth orders for 1998 from first to fourth birth are -0.05, -0.06, -0.07 and -0.05 respectively.

**Figure 5.2.2.36** TFR and Adjusted TFR for first four birth orders, Turkish mother tongue group, 1998



Although the shapes of plots look similar for 1998 and 2003, values for first and second birth orders of 2003 are lower in level.

**Figure 5.2.2.37** TFR and Adjusted TFR for first four birth orders, Turkish mother tongue group, 2003




The differences between adjusted values and regular $TFR_i$ for women whose mother tongue are Kurdish are relatively higher for 1993 (Figure 5.2.2.38). The adjustment brings the level of first birth up to 0.87 from a value of 0.58. The shape of the adjusted series is additionally more likely to be real than the regular series, first birth has the highest level and it decreases regularly afterwards.

**Figure 5.2.2.38** TFR and Adjusted TFR for first four birth orders, Kurdish mother tongue group, 1993

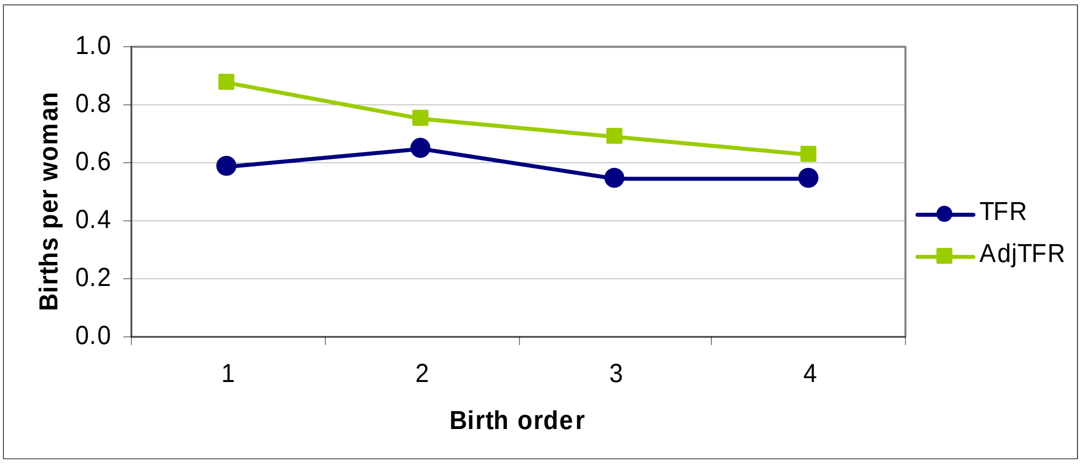
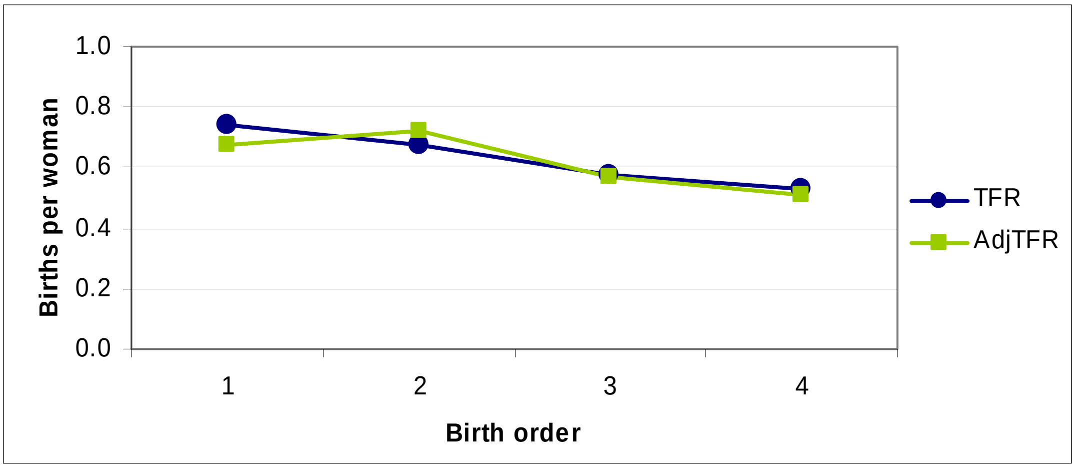


**Figure 5.2.2.39** TFR and Adjusted TFR for first four birth orders, Kurdish mother tongue group, 1998




As seen in Table 5.1.5, mean age at first birth has decreased from 22.5 to 22.0 from 1998 to 2003, thus lower adjusted $TFR_1$ values are observed after adjustment for 1998 and 2003 as seen in Figure 5.2.2.39 and Figure 5.2.2.40. The overall tempo effect is found to be 0.05 for 1998.

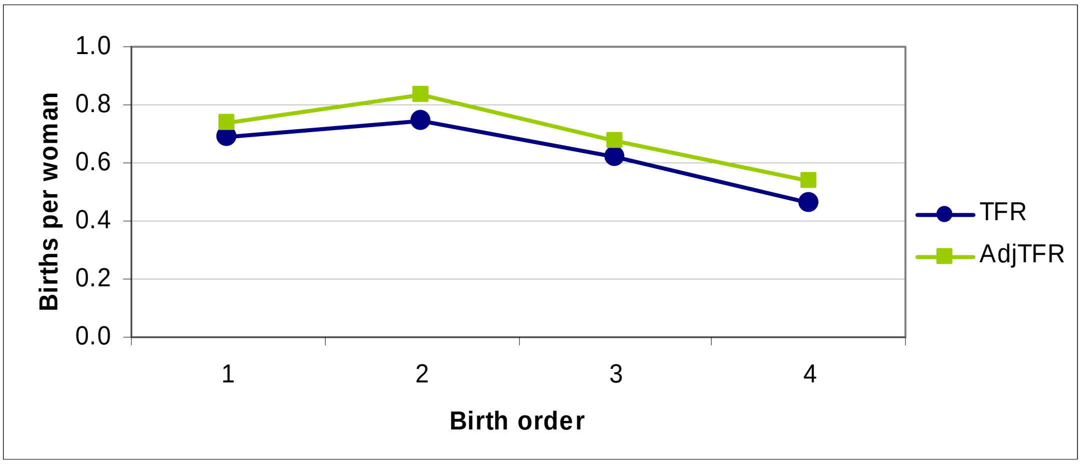
Figure 5.2.2.40 shows generally lower levels of $TFR_i$ and adjusted $TFR_i$ for 2003. For both 1998 and 2003 the shape of the adjusted series have the problem of showing higher levels of second birth than first birth.

**Figure 5.2.2.40** TFR and Adjusted TFR for first four birth orders, Kurdish mother tongue group, 2003


Similar to that of urban to rural migrants, the figures for women having mother tongues other than Turkish and Kurdish can be found in Appendix B, since the number of cases in this group is low.

The distribution of $TFR_i$ and adjusted $TFR_i$ seem to be problematic for Figures 5.2.2.41 and 5.2.2.43 in the sense that the level of second birth is supposed to be lower than the first. The adjustment procedure exaggerates these differences. While the difference between the levels of $TFR_1$ and $TFR_2$ is -0.06 for 1993, this difference is -0.10 for the adjusted $TFR_i$ (Appendix C). The overall tempo effect for 1993 is -0.27 (Table 5.2.1.1).

**Figure 5.2.2.41** TFR and Adjusted TFR for first four birth orders, women with no education or have not completed primary school, 1993




The adjusted series for $TFR_i$ of 1998 has a more linear shape than the series of regular $TFR_i$. The overall level of TFR changes slightly after adjustment, mostly due to tempo effects on second birth, from a value of 4.03 to 4.12 (Table 5.2.1.1). Figure 5.2.2.43 has the same problem with Figure 5.2.2.41, an exaggerated difference is observed between the levels of first and second birth. The overall tempo effect is found to be -0.09 for 2003.

**Figure 5.2.2.42** TFR and Adjusted TFR for first four birth orders, women with no education or have not completed primary school, 1998

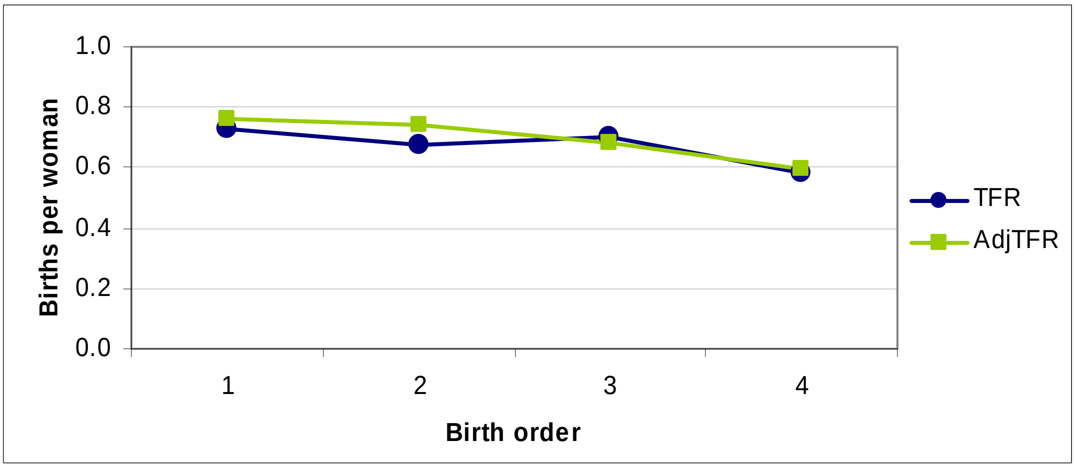
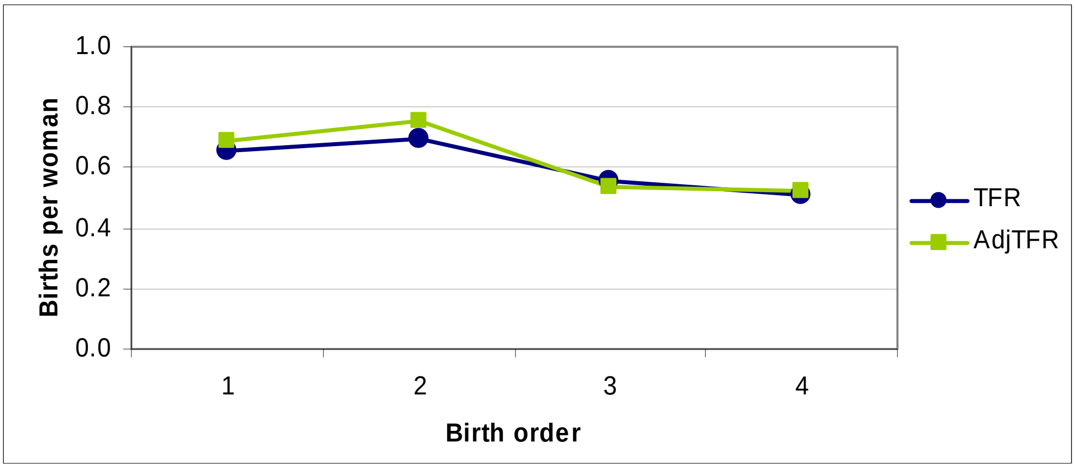


**Figure 5.2.2.43** TFR and Adjusted TFR for first four birth orders, women with no education or have not completed primary school, 2003




Small changes between adjusted and regular $TFR_i$ values are observed for women who have completed first level primary school (Figures 5.2.2.44, 5.2.2.45, 5.2.2.46). Minor postponements are observed for 1993, the overall tempo effect is -0.15. Although there are increases in the level of third and fourth births, the level of first birth is pulled down for 1998 and 2003, thus resulting in positive tempo effects of 0.05 and 0.04 respectively (Table 5.2.1.1).

**Figure 5.2.2.44** TFR and Adjusted TFR for first four birth orders, women completed first level primary school, 1993

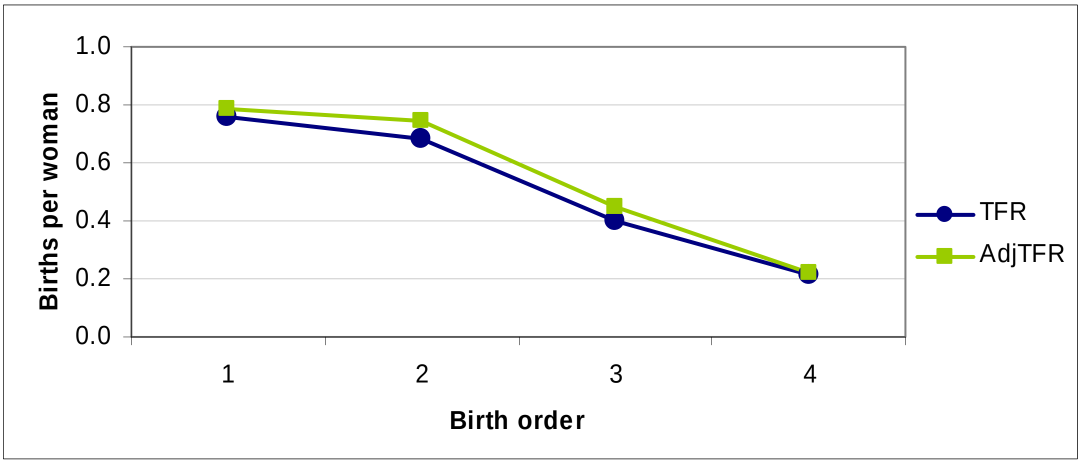
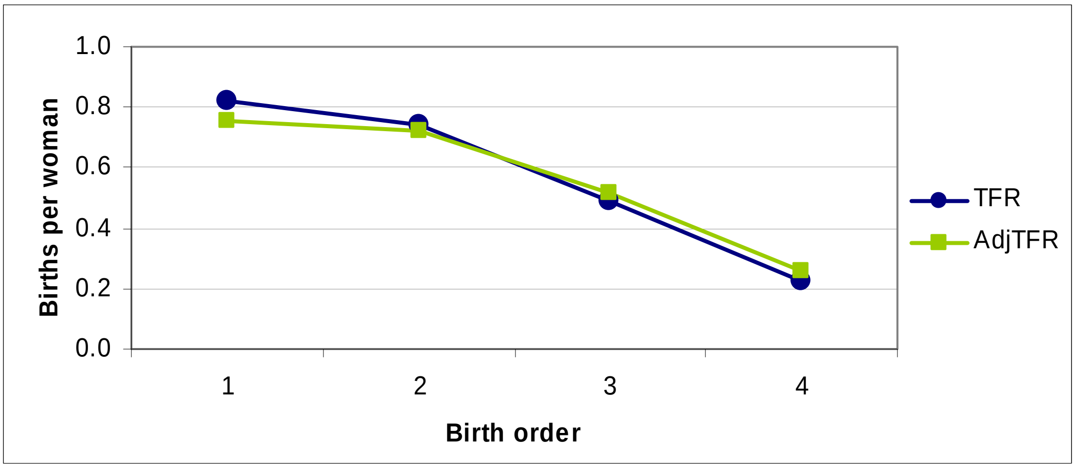


**Figure 5.2.2.45** TFR and Adjusted TFR for first four birth orders, women completed first level primary school, 1998

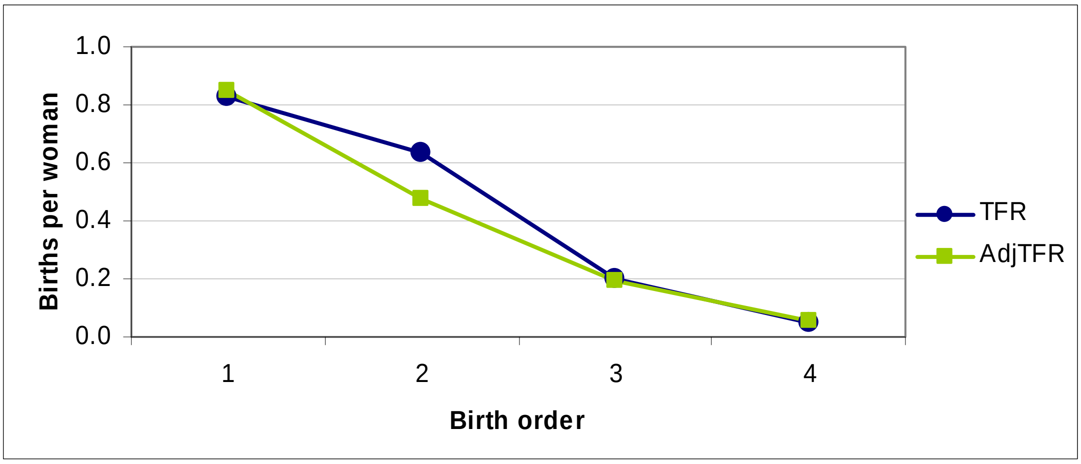

Although the figure for 1998 looks very similar to that of 2003, the overall level for 2003 is lower. While the level of $TFR_i$ is 2.51 and the level of adjusted $TFR_i$ is 2.46 for 1998, these values are 2.44 and 2.40 for 2003 respectively (Table 5.2.1.1).

**Figure 5.2.2.46** TFR and Adjusted TFR for first four birth orders, women completed first level primary school, 2003




Women who have completed second level primary school or higher tend to have the largest differences between the series of $TFR_i$ and adjusted $TFR_i$ (Figures 5.2.2.47, 5.2.2.48 and 5.2.2.49). Small changes have taken for first, second and fourth births place in terms of timing, however, the tempo effect for second birth is 0.16.

**Figure 5.2.2.47** TFR and Adjusted TFR for first four birth orders, women completed second level primary school or higher, 1993




Figures 5.2.2.48 and 5.2.2.49 show that the adjustments for 1998 and 2003 have increased levels of TFR, unlike 1993. The increase is largely due to tempo effects on third birth order, lowering the gap between the levels of second and third birth. The change in mean age at second birth is 2.2 years (Table 5.1.6), mostly responsible for the tempo effect of 0.25 for 1998 and 0.22 for 2003 (Table 5.2.1.1).

**Figure 5.2.2.48** TFR and Adjusted TFR for first four birth orders, women completed second level primary school or higher, 1998

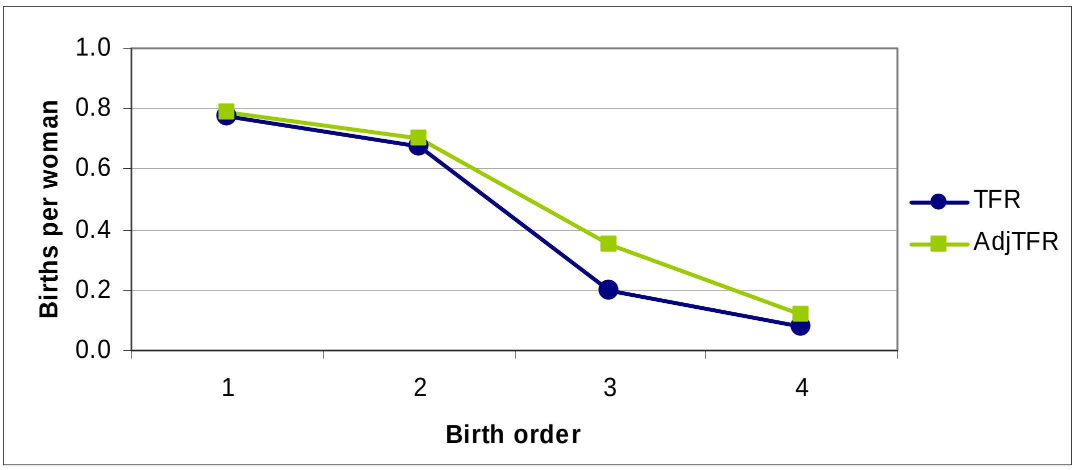
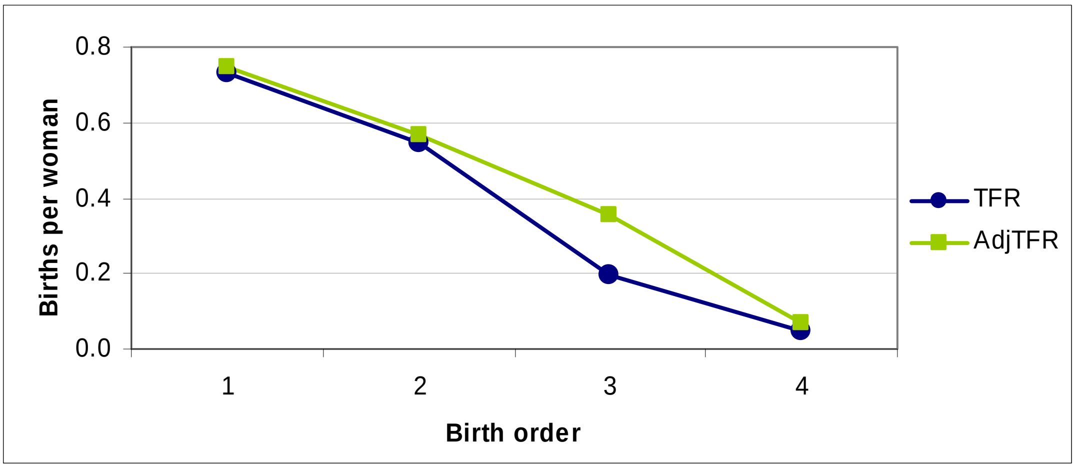


**Figure 5.2.2.49** TFR and Adjusted TFR for first four birth orders, women completed second level primary school or higher, 2003



# CHAPTER 6
# CONCLUSION AND DISCUSSION

The aim of this thesis has been the examination of the changes in the timing of fertility and its effects on total fertility rate for the recent years in Turkey. In order to do so, an adjustment procedure by Bongaarts and Feeney (1998) has been applied on data from Turkish Demographic and Health Surveys of 1993, 1998 and 2003.

Descriptive results for Turkey have revealed that order specific mean ages at childbearing have generally increased with respect to survey date, resulting in overall tempo effects of -0.24, -0.20 and – 0.19 for TDHS 1993, 1998 and 2003 respectively. These values seem moderate when compared to those available in the literature.

The almost constant overall tempo effect for Turkey, calculated from the three surveys, suggest that the extent of changes in fertility timing has not changed very much. This shows that the timing of fertility is not deeply affected by temporary events such as economic crises, but rather tends to change constantly. However, it should be kept in mind that, this picture could have been different were annual calculations possible. Such calculations would be able to show the annual changes in the ages at childbearing, and the effects of the 1994 and 2001 economic crises on fertility timing could be seen, if any. These calculations may be possible in the future after the completion of the vital registration system of Turkey, the Address Based Population Registration System that the Turkish Statistical Institute is currently working on.

A topic of discussion for European countries in the literature is whether low levels of fertility in these countries will recover to levels that would have been achieved in the absence of postponement, should postponement end. If an increasing overall negative tempo effect trend was observed from the three surveys, it could be argued whether the fertility decline in Turkey is *real*. TFR could have seemed to be declining while the only changes would be in terms of fertility tempo rather than fertility quantum. However, the close values for tempo effect show that there are actually decreases in fertility quantum. The level of TFR may be expected to rise about 0.2 should postponement stop immediately, however, this amount would probably be lower due to decreasing quantum component. Additionally, there does not seem to be a reason why increases in mean ages at childbearing should stop in the near future.

One of the aims of this thesis was to see the differences in timing of children for women of different characteristics, and to see which groups' fertilities were most effected by changes in timing. As mentioned above, empirical results showed tempo effects for Turkey for the three survey years as around -0.20. This tempo effect showed larger differences for some groups of women. Among all categories of all variables, the Kurdish mother tongue group showed the largest tempo effects. Kurdish mother tongue group has a fertility rate almost twice as large as that of the Turkish mother tongue group. If fertility transition is considered differently for different groups, it could be said that Turkish and Kurdish mother tongue groups stood in different stages of it. More decline in fertility is expected for Kurdish speaking women in the future, if they are to go through a classical demographic transition, and postponements will accompany naturally.

Since fertility postponement is generally studied for developed countries that are said to be going through a second demographic transition, and postponement is thought to be a part of this process, it could be expected for Western region to show the highest tempo effect, having the lowest level of fertility. However, empirical results fail this expectation. Taking the average of the three tempo effects for the three surveys, it can be seen that West shows the lowest tempo effect. The other regions show higher levels of fertility and higher rates of decline in fertility. Why western region has the lowest tempo effects may be explained with Lesthaehge and Willems' (1999) point of view.

Lesthaeghe and Willems (1999) suggest in their study that it is likely for increases in female education and employment to slow down in Europe, reaching levels of saturation. According to them, this may lead to smaller changes in female education and employment, bringing a halt to postponement of childbearing. From this point of view, postponement may be expected to be more rapid in developing countries, since the potential of women's enrollment in education and participation in labour force are still very high compared to those of developed countries.

Based on this view, it may be suggested that the higher the level of fertility, the higher the potential for it to decrease faster. Also, it is likely that the faster the fall in fertility, the faster the increase in mean ages at childbearing. This view may explain why West is showing the least increase in mean age at childbearing, showing the lowest tempo effects among all.

The findings for different groups of educational attainment seem to contradict with the result obtained for regional adjustments. Among educational groups, women who have second level primary school or higher education show the largest tempo effects. To explain this from a second demographic transition theory point of view, it may be suggested that women of lower levels of fertility are usually those with higher education, labour force participation and users of modern contraception, having the strongest control over their fertility with the highest need of accuracy of the timing of childbearing. This may explain why the most educated group of women is showing the largest tempo effects.

Among women of different migration status, urban native women were found to have largest tempo effect on average. This finding may be explained with the view given in the previous paragraph. Interestingly, the lowest tempo effects belonged to rural to urban migrants.

A point worthy to note is that, as can be seen in Appendix C, some categories of women show decreasing mean ages at childbearing for the first birth order. These categories are; rural for type of place of residence, north, south and east among five regions, rural natives among migration categories, Kurdish speaking women among mother tongue groups and women who have completed first level primary school among educational categories. Except the last one, the relatively more *disadvantaged* categories have experienced this. This decrease is observed only from the five year period preceding 1998 to the five year period preceding 2003, and almost for first births only. The fact that this observation is for first births only suggests that is associated to age at first marriage. Decreasing mean age at first marriage is not an expected phenomenon. The reason for this decrease might be a more than normal increase in the age at first marriage in the five year period preceding 1998, and the decrease may be the recovery to the normal ages in the five year period preceding 2003. An increase in age at marriage and thus first birth during the five year period preceding 1998 may be possible for the above categories of women due to the economic crisis of 1994 in Turkey.

Going back to the aims of the thesis given in the introduction, in short, the discussions above have shown that an additional measure for period fertility is needed for Turkey, since mean age at childbearing is increasing. The adjusted TFR may be presented together with the conventional TFR to show the level that would have been observed in the absence of changes in timing. The method to calculate a tempo free estimate of TFR is the Bongaarts and Feeney adjustment in this thesis, and it shows levels above the regular TFR, an expected result. Complex methods to reveal tempo effects exist that can be applied to data on Turkey, hopefully to which this thesis may build a basis.

The application of the adjustment to different groups of women show some differences which may be explained to some extent, but require further research. Calculations have shown that the application of the method on survey data is possible for Turkey; however, the reliability of the adjustment decrease as number of cases get smaller and standard errors become larger. Therefore it is best to apply the adjustment to Turkey as a whole, and to variables that have categories of large numbers of cases.

Although literature focuses widely on tempo effects in developed countries and briefly on developing countries, attention to tempo effects in developing countries is also necessary. There are developments that will be briefly discussed below, which are not unique to Turkey, rather to many developing countries, that suggest the need to focus on fertility timing and its effects on period fertility.

A key issue is female education. The effect of education on fertility is long known, as women are enrolled in education in larger proportions and are exposed for longer periods of time, they tend to have fewer and later births. Data from Turkey support that women's enrollment in education has been increasing for a long time, and still is. Thus, education is a reason why women should be bearing children at higher ages. The proportion of women working in urban sectors has also increased in time, increasing women's opportunity costs of childbearing.

The changes mentioned above, and probably many more, have been effective on the timing of marriage. Since almost all childbearing in Turkey takes place within marriage, the timing of marriage has a direct effect on when the first child is born. Data support that women's mean age at first marriage is increasing.

The main tool for achieving control over limiting and spacing fertility is contraception. In time, Turkish women have adopted family planning in increasing proportions. Furthermore, the share of modern method users have increased in time, which is perhaps more important from a timing perspective.

Cultural factors are also in action in Turkey. Assuming mother tongue as a proxy variable for culture, women speaking Turkish as their mother tongue differ from those speaking Kurdish in both tempo and quantum of fertility. Reproductive behaviour changes for these groups, women of the group first mentioned tend to have fewer and later births than the latter. Region may also be considered as a proxy variable for culture, as well as type of residence, and these variables too present findings supporting the existence of cultural factors.

With the addition of the effects of others, the developments above have been effective on fertility decline in Turkey, and they have additionally been key elements in increasing ages at childbearing. Such developments exist in many developing countries, so it would be helpful to focus on tempo effects as well when interpreting the TFR values of these countries.

Although levels of female education and employment are high in developed countries, fertility postponement still exists, and this is usually explained with cultural theories or the second demographic transition theory. It is not for certain whether Turkey would show signs of a similar demographic situation in the following years, thus it is hard to say if postponements will stop in the near future according to this point of view.

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# APPENDIX A

# NUMBER OF CASES FOR CALCULATIONS

**Table A. Weighted number of cases used for the calculation $TFR_i$**

| | 1993 | 1998 | 2003 |
|---|---|---|---|
| **Turkey** | 9712 | 8576 | 11949 |
| **Type of residence** | | | |
| Urban | 5990 | 5704 | 8388 |
| Rural | 4036 | 2872 | 3561 |
| Missing | - | 0 | 0 |
| **Region (De jure)** | | | |
| West | 3310 | 3244 | 4602 |
| South | 1569 | 1270 | 1594 |
| Central | 2180 | 1928 | 2715 |
| North | 782 | 659 | 917 |
| East | 1704 | 1398 | 2120 |
| Missing | 34 | 77 | 0 |
| **Migration** | | | |
| Urban native | 3350 | 3748 | 5570 |
| Urbanto rural migrant | 455 | 337 | 337 |
| Rural native | 3406 | 2316 | 3190 |
| Rural to urban migrant | 2685 | 1984 | 2635 |
| Missing | 130 | 191 | 217 |
| **Mother tongue** | | | |
| Turkish | 7928 | 7079 | 9860 |
| Kurdish | 1273 | 1222 | 1726 |
| Other | 377 | 234 | 352 |
| Missing | - | 41 | 11 |
| **Education** | | | |
| No education/ primary incomplete | 2592 | 1869 | 2215 |
| First level primary | 5166 | 4775 | 5406 |
| Secondary level primary or higher | 1924 | 1932 | 4328 |
| Missing | - | 0 | 0 |

# APPENDIX B
# FIGURES EXCLUDED IN CHAPTER 5

**Figure B.1** Birth order-specific total fertility rates for urban to rural migrants

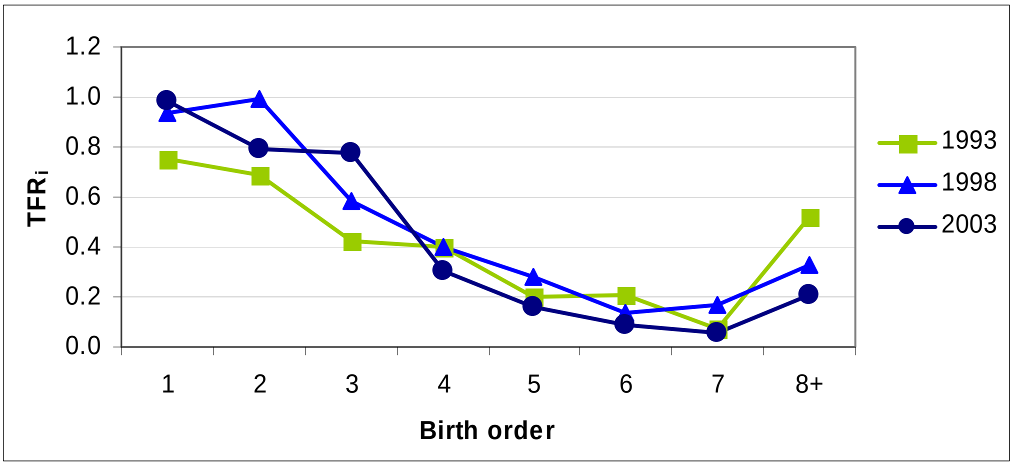


**Figure B.2** Birth order-specific mean ages at childbearing for urban to rural migrants

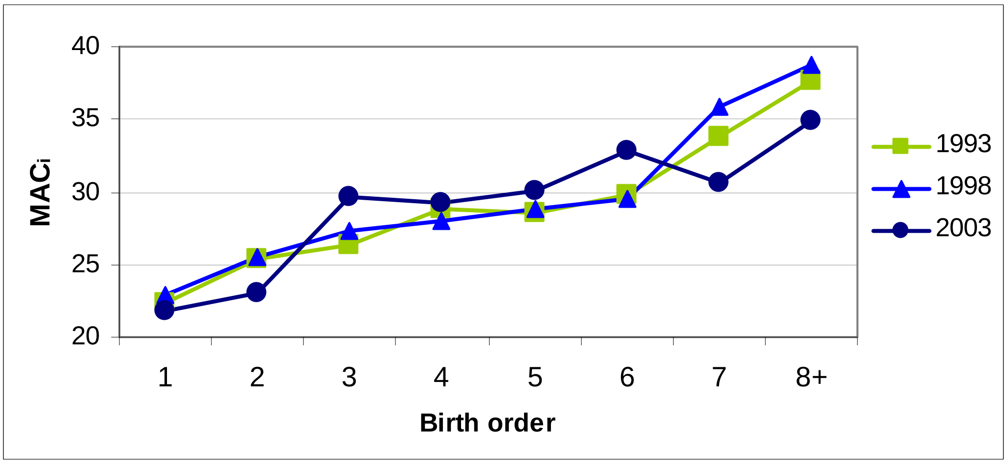

**Figure B.3** TFR and Adjusted TFR for first four birth orders, urban to rural migrants, 1993

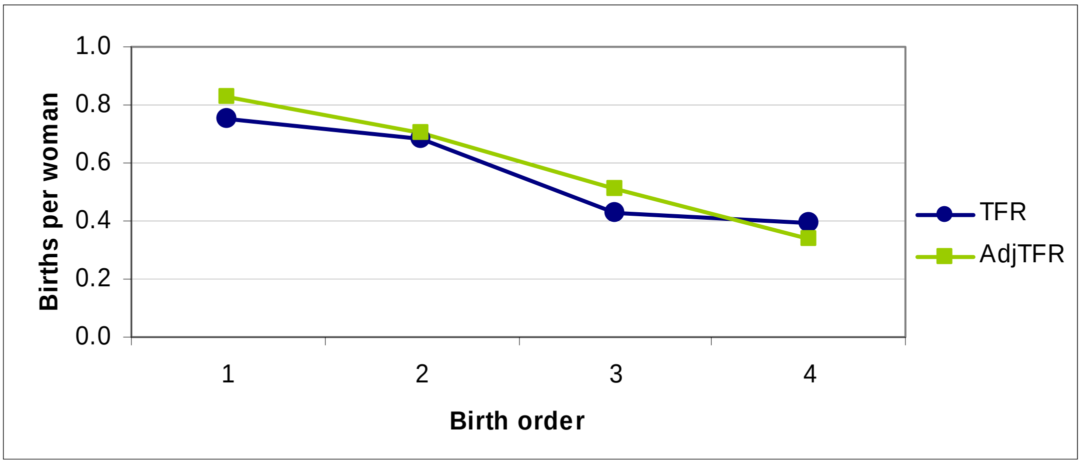


**Figure B.4** TFR and Adjusted TFR for first four birth orders, urban to rural migrants, 1998

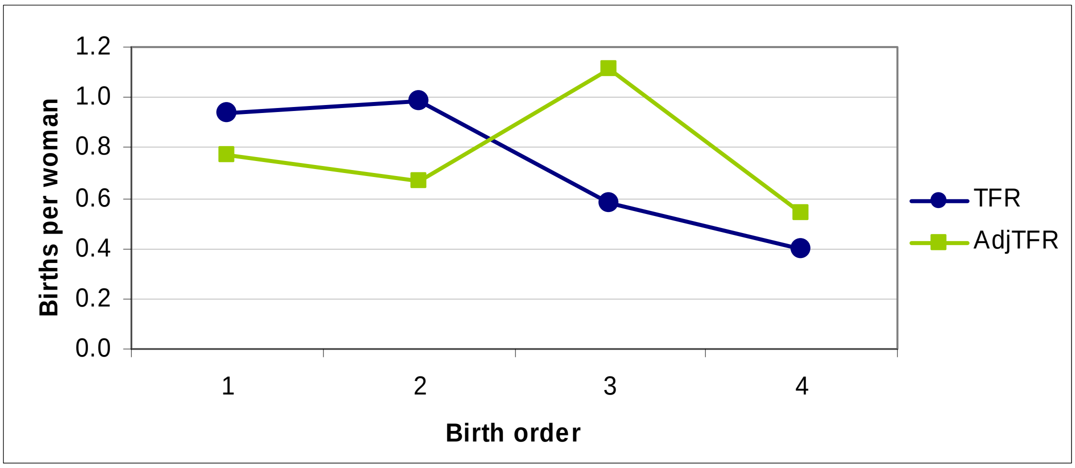


**Figure B.5** TFR and Adjusted TFR for first four birth orders, urban to rural migrants, 2003

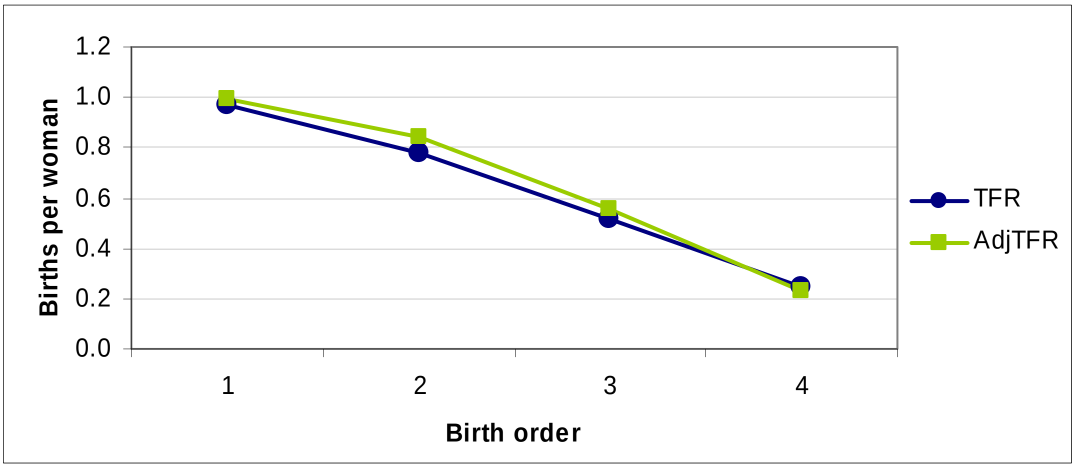

**Figure B.6** Birth order-specific total fertility rates for other mother tongue category

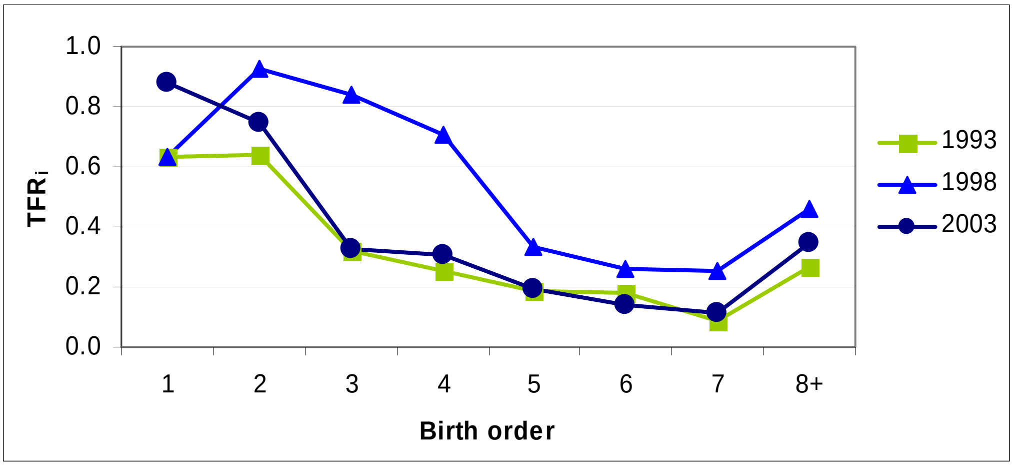


**Figure B.7** Birth order-specific mean ages at childbearing for other mother tongue category

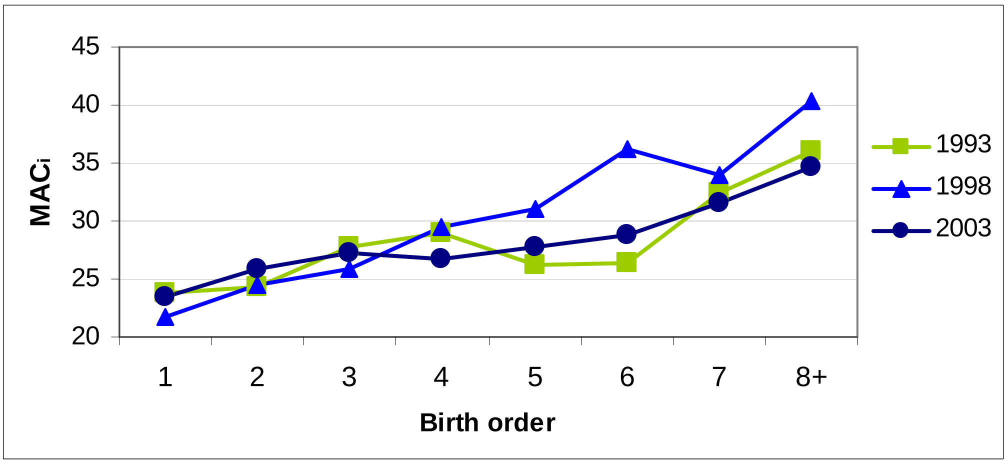


**Figure B.8** TFR and Adjusted TFR for first four birth orders, other mother tongue category, 1993

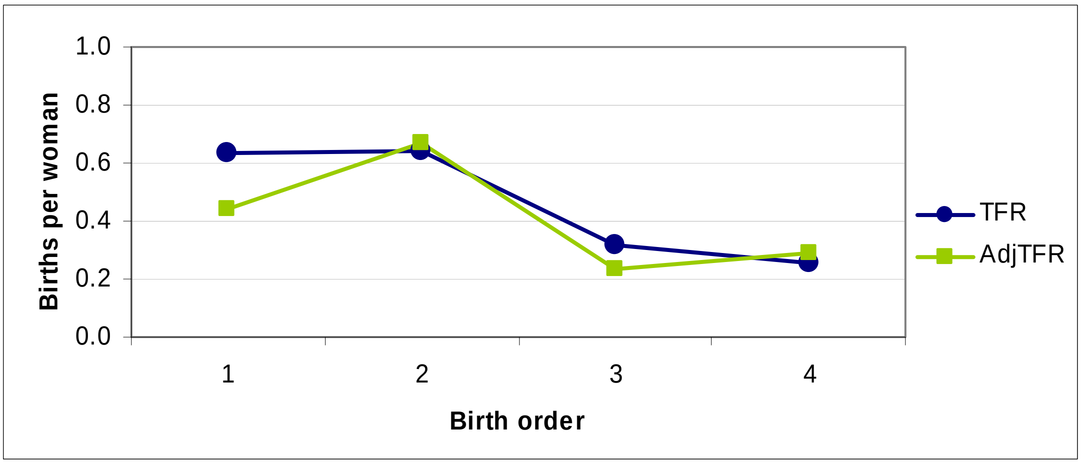

**Figure B.9** TFR and Adjusted TFR for first four birth orders, other mother tongue category, 1998

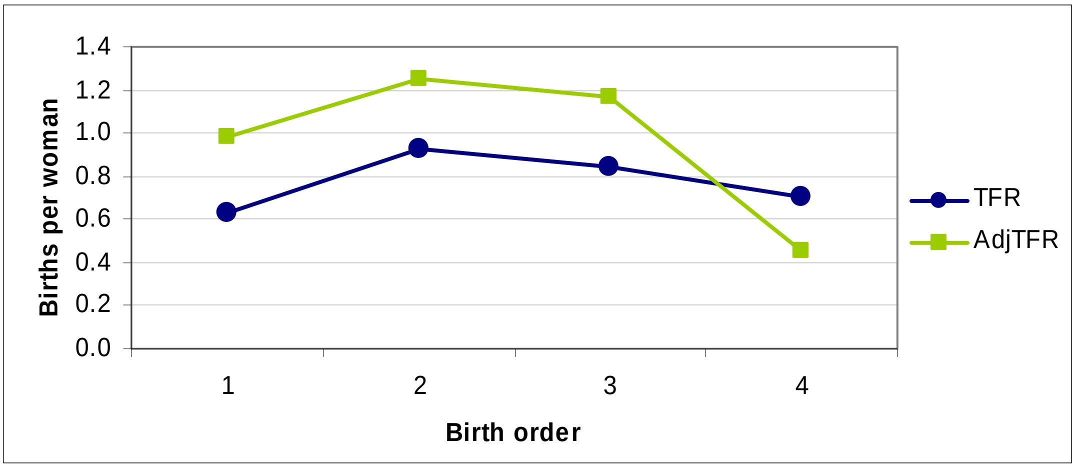


**Figure B.10** TFR and Adjusted TFR for first four birth orders, other mother tongue category, 2003

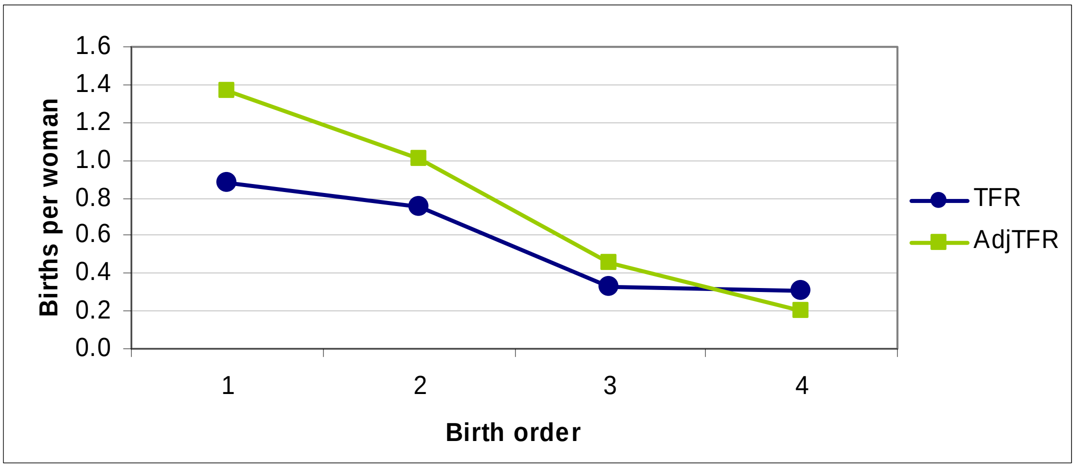

TABLE C

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# APPENDIX D
# ADJUSTMENTS FOR TURKEY BY THE ALTERNATIVE APPROACH FOR TIME PERIODS

**Table D 1.** Adjustments of TFR for the period between 12 and 47 months preceding survey date, using the mean ages at birth for the first and last 24 months of the five year period

| | 1993 | | | 1998 | | | 2003 | | |
|---|---|---|---|---|---|---|---|---|---|
| | TFR | AdjTFR | Tempo effect | TFR | AdjTFR | Tempo effect | TFR | AdjTFR | Tempo effect |
| **1** | 0.77 | 0.85 | -0.08 | 0.80 | 1.16 | -0.36 | 0.74 | 0.68 | 0.05 |
| **2** | 0.63 | 0.53 | 0.10 | 0.70 | 0.95 | -0.25 | 0.66 | 0.84 | -0.18 |
| **3** | 0.40 | 0.57 | -0.17 | 0.42 | 0.90 | -0.48 | 0.40 | 0.66 | -0.26 |
| **4** | 0.23 | 0.41 | -0.18 | 0.22 | 0.26 | -0.05 | 0.23 | 0.29 | -0.06 |
| **5** | 0.16 | - | - | 0.12 | - | - | 0.11 | - | - |
| **6** | 0.12 | - | - | 0.09 | - | - | 0.08 | - | - |
| **7** | 0.10 | - | - | 0.07 | - | - | 0.07 | - | - |
| **8+** | 0.21 | - | - | 0.17 | - | - | 0.14 | - | - |
| **Total** | 2.62 | 2.96 | -0.34 | 2.59 | 3,73 | -1.14 | 2.42 | 2.86 | -0.45 |

**Table D 2.** Adjustments of TFR for the period between 12 and 47 months preceding survey date, using the mean ages at birth for the first and last 12 months of the five year period

| | 1993 | | | 1998 | | | 2003 | | |
|---|---|---|---|---|---|---|---|---|---|
| | TFR | AdjTFR | Tempo effect | TFR | AdjTFR | Tempo effect | TFR | AdjTFR | Tempo effect |
| **1** | 0.77 | 0.94 | -0.17 | 0.80 | 1.16 | -0.36 | 0.74 | 0.64 | 0.10 |
| **2** | 0.63 | 0.27 | 0.37 | 0.70 | 0.95 | -0.25 | 0.66 | 1.10 | -0.45 |
| **3** | 0.40 | 0.60 | -0.20 | 0.42 | 1.39 | -0.97 | 0.40 | 0.47 | -0.07 |
| **4** | 0.23 | 0.35 | -0.12 | 0.22 | 0.31 | -0.09 | 0.23 | 0.29 | -0.06 |
| **5** | 0.16 | - | - | 0.12 | - | - | 0.11 | - | - |
| **6** | 0.12 | - | - | 0.09 | - | - | 0.08 | - | - |
| **7** | 0.10 | - | - | 0.07 | - | - | 0.07 | - | - |
| **8+** | 0.21 | - | - | 0.17 | - | - | 0.14 | - | - |
| **Total** | 2.62 | 2.75 | -0.13 | 2.59 | 4,27 | -1.67 | 2.42 | 2.89 | -0.47 |

**Table 5.1.3** Birth order-specific total fertility rates and mean ages at childbearing by regions

| | West | | | North | | | Central | | | South | | | East | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1993** | **1998** | **2003** | **1993** | **1998** | **2003** | **1993** | **1998** | **2003** | **1993** | **1998** | **2003** | **1993** | **1998** | **2003** |
| **TFRi** | | | | | | | | | | | | | | | |
| **1** | 0.80 | 0.82 | 0.74 | 0.84 | 0.80 | 0.58 | 0.74 | 0.87 | 0.74 | 0.65 | 0.85 | 0.72 | 0.64 | 0.72 | 0.67 |
| **2** | 0.65 | 0.67 | 0.61 | 0.70 | 0.67 | 0.58 | 0.64 | 0.78 | 0.64 | 0.62 | 0.68 | 0.62 | 0.60 | 0.69 | 0.64 |
| **3** | 0.27 | 0.27 | 0.29 | 0.41 | 0.46 | 0.45 | 0.44 | 0.45 | 0.36 | 0.42 | 0.47 | 0.42 | 0.55 | 0.64 | 0.58 |
| **4** | 0.12 | 0.12 | 0.12 | 0.22 | 0.31 | 0.23 | 0.24 | 0.21 | 0.16 | 0.28 | 0.24 | 0.23 | 0.45 | 0.49 | 0.45 |
| **5** | 0.06 | 0.04 | 0.04 | 0.17 | 0.19 | 0.09 | 0.13 | 0.11 | 0.07 | 0.16 | 0.13 | 0.12 | 0.40 | 0.36 | 0.36 |
| **6** | 0.02 | 0.06 | 0.03 | 0.11 | 0.08 | 0.02 | 0.10 | 0.06 | 0.04 | 0.13 | 0.09 | 0.07 | 0.42 | 0.30 | 0.30 |
| **7** | 0.03 | 0.03 | 0.03 | 0.10 | 0.04 | 0.04 | 0.06 | 0.02 | 0.05 | 0.08 | 0.06 | 0.06 | 0.34 | 0.31 | 0.21 |
| **8+** | 0.03 | 0.03 | 0.03 | 0.17 | 0.14 | 0.05 | 0.15 | 0.04 | 0.02 | 0.11 | 0.08 | 0.08 | 0.90 | 0.83 | 0.69 |
| **TFR** | 1.98 | 2.03 | 1.89 | 2.71 | 2.69 | 2.05 | 2.51 | 2.55 | 2.09 | 2.45 | 2.59 | 2.32 | 4.30 | 4.34 | 3.90 |
| **MACi** | | | | | | | | | | | | | | | |
| **1** | 22.8 | 23.2 | 23.6 | 22.6 | 23.2 | 22.9 | 22.0 | 22.3 | 22.8 | 22.8 | 23.4 | 23.2 | 21.9 | 22.6 | 22.4 |
| **2** | 26.1 | 26.5 | 27.1 | 25.4 | 25.0 | 25.5 | 24.6 | 25.3 | 25.6 | 25.6 | 25.6 | 25.9 | 24.1 | 24.4 | 24.4 |
| **3** | 28.5 | 28.7 | 29.1 | 27.3 | 27.0 | 28.8 | 27.2 | 27.8 | 28.9 | 27.4 | 28.5 | 29.6 | 25.7 | 26.7 | 27.1 |
| **4** | 30.0 | 30.9 | 31.6 | 28.7 | 29.8 | 30.6 | 28.7 | 29.3 | 31.0 | 29.4 | 31.1 | 31.3 | 27.5 | 27.4 | 28.4 |
| **5** | 31.8 | 31.5 | 32.7 | 30.2 | 30.1 | 31.1 | 29.9 | 32.0 | 33.3 | 30.3 | 32.5 | 31.4 | 29.8 | 28.8 | 29.8 |
| **6** | 28.4 | 36.2 | 31.5 | 31.1 | 31.2 | 34.8 | 33.8 | 32.4 | 32.5 | 32.9 | 34.1 | 32.3 | 30.9 | 30.6 | 31.9 |
| **7** | 32.3 | 35.7 | 30.1 | 34.4 | 32.9 | 35.3 | 34.2 | 32.5 | 36.1 | 34.9 | 33.2 | 32.9 | 33.2 | 32.5 | 32.3 |
| **8+** | 34.9 | 35.8 | 33.0 | 37.6 | 36.8 | 34.8 | 36.7 | 38.3 | 43.8 | 36.5 | 36.5 | 38.0 | 36.5 | 36.9 | 37.2 |
| **MAC** | 25.7 | 26.3 | 26.7 | 26.7 | 26.6 | 26.8 | 26.3 | 25.8 | 26.4 | 27.1 | 27.0 | 27.3 | 28.8 | 28.5 | 28.7 |

**Table 5.1.4** Birth order-specific total fertility rates and mean ages at childbearing by migration categories

| | Urban native | | | Urban to rural | | | Rural native | | | Rural to urban | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1993** | **1998** | **2003** | **1993** | **1998** | **2003** | **1993** | **1998** | **2003** | **1993** | **1998** | **2003** |
| **TFRi** | | | | | | | | | | | | |
| **1** | 0.82 | 0.79 | 0.67 | 0.75 | 0.94 | 0.98 | 0.60 | 0.78 | 0.63 | 0.75 | 0.97 | 0.97 |
| **2** | 0.66 | 0.67 | 0.59 | 0.68 | 0.99 | 0.79 | 0.62 | 0.67 | 0.60 | 0.66 | 0.83 | 0.78 |
| **3** | 0.33 | 0.33 | 0.30 | 0.42 | 0.58 | 0.78 | 0.42 | 0.50 | 0.44 | 0.44 | 0.49 | 0.51 |
| **4** | 0.19 | 0.16 | 0.11 | 0.40 | 0.40 | 0.30 | 0.30 | 0.32 | 0.36 | 0.21 | 0.23 | 0.25 |
| **5** | 0.11 | 0.07 | 0.06 | 0.20 | 0.28 | 0.16 | 0.24 | 0.22 | 0.20 | 0.12 | 0.12 | 0.14 |
| **6** | 0.08 | 0.04 | 0.05 | 0.21 | 0.14 | 0.09 | 0.20 | 0.16 | 0.13 | 0.09 | 0.11 | 0.09 |
| **7** | 0.05 | 0.04 | 0.03 | 0.07 | 0.17 | 0.06 | 0.17 | 0.12 | 0.13 | 0.08 | 0.06 | 0.06 |
| **8+** | 0.09 | 0.06 | 0.04 | 0.52 | 0.33 | 0.21 | 0.39 | 0.30 | 0.29 | 0.13 | 0.13 | 0.13 |
| **TFR** | 2.33 | 2.16 | 1.84 | 3.26 | 3.82 | 3.36 | 2.95 | 3.07 | 2.78 | 2.49 | 2.95 | 2.93 |
| **MACi** | | | | | | | | | | | | |
| **1** | 23.1 | 23.6 | 24.0 | 22.4 | 22.8 | 21.8 | 21.9 | 22.7 | 22.3 | 22.2 | 21.8 | 22.0 |
| **2** | 26.5 | 26.9 | 27.1 | 25.4 | 25.5 | 23.1 | 24.2 | 24.5 | 25.2 | 25.1 | 24.5 | 24.8 |
| **3** | 27.8 | 28.4 | 29.7 | 26.4 | 27.3 | 29.6 | 26.1 | 27.0 | 27.5 | 27.6 | 27.2 | 27.6 |
| **4** | 29.5 | 29.8 | 31.8 | 28.8 | 28.0 | 29.3 | 27.6 | 28.5 | 29.5 | 29.2 | 29.6 | 29.2 |
| **5** | 30.7 | 32.0 | 30.2 | 28.6 | 28.8 | 30.1 | 29.5 | 29.5 | 30.1 | 30.6 | 30.6 | 31.3 |
| **6** | 32.5 | 30.6 | 31.3 | 29.8 | 29.6 | 32.9 | 30.7 | 31.2 | 31.5 | 32.5 | 34.3 | 31.8 |
| **7** | 34.0 | 32.8 | 33.1 | 33.8 | 35.9 | 30.7 | 33.5 | 31.9 | 33.2 | 32.6 | 33.8 | 30.6 |
| **8+** | 34.4 | 36.8 | 33.8 | 37.6 | 38.8 | 34.9 | 35.6 | 36.8 | 36.6 | 38.8 | 36.0 | 37.0 |
| **MAC** | 26.6 | 26.7 | 27.1 | 27.9 | 27.4 | 26.2 | 27.3 | 27.0 | 27.7 | 26.5 | 25.8 | 25.9 |

**Table 5.2.1.1** Total fertility rate, adjusted total fertility rate and tempo effect by survey years

| | TFR | | | AdjTFR | | | Tempo effect | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1993** | **1998** | **2003** | **1993** | **1998** | **2003** | **1993** | **1998** | **2003** |
| **Type of Residence** | | | | | | | | | |
| Urban | 2.39 | 2.39 | 2.13 | 2.57 | 2.58 | 2.31 | -0.18 | -0.20 | -0.18 |
| Rural | 2.94 | 3.10 | 2.83 | 3.16 | 3.28 | 3.02 | -0.22 | -0.18 | -0.19 |
| **Region** | | | | | | | | | |
| West | 1.98 | 2.03 | 1.89 | 2.14 | 2.25 | 2.10 | -0.16 | -0.22 | -0.21 |
| North | 2.71 | 2.69 | 2.05 | 2.80 | 3.04 | 2.38 | -0.09 | -0.35 | -0.33 |
| Central | 2.51 | 2.55 | 2.09 | 2.77 | 2.92 | 2.38 | -0.27 | -0.37 | -0.30 |
| South | 2.45 | 2.59 | 2.32 | 2.80 | 2.75 | 2.46 | -0.35 | -0.16 | -0.15 |
| East | 4.30 | 4.34 | 3.90 | 4.57 | 4.49 | 4.04 | -0.27 | -0.15 | -0.14 |
| **Migration categories** | | | | | | | | | |
| Urban native | 2.33 | 2.16 | 1.84 | 2.53 | 2.50 | 2.12 | -0.19 | -0.34 | -0.28 |
| Urban to rural migrant | 3.26 | 3.82 | 3.36 | 3.38 | 4.00 | 3.74 | -0.12 | -0.18 | -0.38 |
| Rural native | 2.95 | 3.07 | 2.78 | 3.25 | 3.26 | 2.97 | -0.30 | -0.19 | -0.19 |
| Rural to urban migrant | 2.49 | 2.95 | 2.93 | 2.35 | 3.06 | 3.04 | 0.14 | -0.12 | -0.11 |
| **Mother tongue** | | | | | | | | | |
| Turkish | 2.30 | 2.29 | 1.98 | 2.51 | 2.53 | 2.21 | -0.21 | -0.24 | -0.23 |
| Kurdish | 4.81 | 4.30 | 4.37 | 5.43 | 4.24 | 4.32 | -0.62 | 0.05 | 0.04 |
| Other | 2.57 | 4.42 | 3.05 | 2.35 | 5.16 | 3.81 | 0.22 | -0.75 | -0.77 |
| **Educational attainment** | | | | | | | | | |
| No education/ primary incomplete | 3.92 | 4.03 | 3.97 | 4.19 | 4.12 | 4.06 | -0.27 | -0.09 | -0.09 |
| First level primary | 2.28 | 2.51 | 2.44 | 2.43 | 2.46 | 2.40 | -0.15 | 0.05 | 0.04 |
| Second level primary | 1.72 | 1.73 | 1.54 | 1.59 | 1.97 | 1.76 | 0.13 | -0.24 | -0.22 |
| **Turkey** | 2.59 | 2.62 | 2.33 | 2.80 | 2.83 | 2.53 | -0.21 | -0.21 | -0.19 |

## APPENDIX C

## RESULTS FOR ORDER SPECIFIC ADJUSTMENTS

**Table C. Results for the order specific adjustments of the first four birth orders**

| | | 1993 | | | 1998 | | | | | 2003 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Birth order** | **TFR** | **AdjTFR*** | **Tempo effect*** | **TFR** | **AdjTFR*** | **AdjTFR**** | **Tempo effect*** | **Tempo effect**** | **TFR** | **AdjTFR**** | **Tempo effect**** |
| **Urban** | **1** | 0.78 | 0.82 | -0.04 | 0.8 | 0.88 | 0.85 | -0.08 | -0.04 | 0.73 | 0.8 | -0.07 |
| | **2** | 0.65 | 0.71 | -0.05 | 0.7 | 0.74 | 0.76 | -0.03 | -0.06 | 0.63 | 0.66 | -0.03 |
| | **3** | 0.38 | 0.43 | -0.05 | 0.38 | 0.43 | 0.43 | -0.06 | -0.05 | 0.36 | 0.41 | -0.05 |
| | **4** | 0.2 | 0.23 | -0.03 | 0.19 | 0.22 | 0.22 | -0.03 | -0.03 | 0.16 | 0.18 | -0.02 |
| | **5** | 0.11 | 0.11 | - | 0.09 | 0.09 | 0.09 | - | - | 0.09 | 0.09 | - |
| | **6** | 0.09 | 0.09 | - | 0.08 | 0.08 | 0.08 | - | - | 0.06 | 0.06 | 0 |
| | **7** | 0.06 | 0.06 | - | 0.05 | 0.05 | 0.05 | - | - | 0.04 | 0.04 | 0 |
| | **8+** | 0.11 | 0.11 | - | 0.09 | 0.09 | 0.09 | - | - | 0.07 | 0.07 | 0 |
| | **TFR** | **2.39** | **2.57** | **-0.18** | **2.39** | **2.58** | **2.57** | **-0.2** | **-0.18** | **2.13** | **2.31** | **-0.18** |
| **Rural** | **1** | 0.65 | 0.75 | -0.11 | 0.83 | 0.76 | 0.97 | 0.07 | -0.14 | 0.68 | 0.62 | 0.05 |
| | **2** | 0.62 | 0.65 | -0.02 | 0.72 | 0.78 | 0.74 | -0.07 | -0.03 | 0.63 | 0.68 | -0.06 |
| | **3** | 0.42 | 0.47 | -0.05 | 0.49 | 0.6 | 0.55 | -0.11 | -0.06 | 0.47 | 0.57 | -0.1 |
| | **4** | 0.3 | 0.35 | -0.04 | 0.32 | 0.39 | 0.36 | -0.07 | -0.05 | 0.35 | 0.44 | -0.08 |
| | **5** | 0.23 | 0.23 | - | 0.21 | 0.21 | 0.21 | - | - | 0.19 | 0.19 | - |
| | **6** | 0.19 | 0.19 | - | 0.14 | 0.14 | 0.14 | - | - | 0.12 | 0.12 | - |
| | **7** | 0.16 | 0.16 | - | 0.12 | 0.12 | 0.12 | - | - | 0.12 | 0.12 | - |
| | **8+** | 0.37 | 0.37 | - | 0.28 | 0.28 | 0.28 | - | - | 0.28 | 0.28 | - |
| | **TFR** | **2.94** | **3.16** | **-0.22** | **3.1** | **3.28** | **3.37** | **-0.18** | **-0.27** | **2.83** | **3.02** | **-0.19** |
| **West** | **1** | 0.8 | 0.85 | -0.05 | 0.82 | 0.9 | 0.88 | -0.08 | -0.06 | 0.74 | 0.81 | -0.07 |
| | **2** | 0.65 | 0.71 | -0.06 | 0.67 | 0.77 | 0.74 | -0.1 | -0.07 | 0.61 | 0.7 | -0.09 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **3** | 0.27 | 0.29 | -0.02 | 0.27 | 0.29 | 0.28 | -0.02 | -0.02 | 0.29 | 0.31 | -0.03 |
| | **4** | 0.12 | 0.14 | -0.03 | 0.12 | 0.14 | 0.15 | -0.02 | -0.03 | 0.12 | 0.14 | -0.02 |
| | **5** | 0.06 | 0.06 | - | 0.04 | 0.04 | 0.04 | - | - | 0.04 | 0.04 | - |
| | **6** | 0.02 | 0.02 | - | 0.06 | 0.06 | 0.06 | - | - | 0.03 | 0.03 | - |
| | **7** | 0.03 | 0.03 | - | 0.03 | 0.03 | 0.03 | - | - | 0.03 | 0.03 | - |
| | **8+** | 0.03 | 0.03 | - | 0.03 | 0.03 | 0.03 | - | - | 0.03 | 0.03 | - |
| | **TFR** | **1.98** | **2.14** | **-0.16** | **2.03** | **2.25** | **2.2** | **-0.22** | **-0.16** | **1.89** | **2.1** | **-0.21** |
| **North** | **1** | 0.84 | 0.95 | -0.11 | 0.8 | 0.76 | 0.91 | 0.04 | -0.1 | 0.58 | 0.55 | 0.03 |
| | **2** | 0.7 | 0.64 | 0.06 | 0.67 | 0.75 | 0.61 | -0.08 | 0.06 | 0.58 | 0.65 | -0.07 |
| | **3** | 0.41 | 0.39 | 0.02 | 0.46 | 0.7 | 0.43 | -0.25 | 0.02 | 0.45 | 0.69 | -0.24 |
| | **4** | 0.22 | 0.28 | -0.06 | 0.31 | 0.38 | 0.39 | -0.07 | -0.08 | 0.23 | 0.28 | -0.05 |
| | **5** | 0.17 | 0.17 | - | 0.19 | 0.19 | 0.19 | - | - | 0.09 | 0.09 | - |
| | **6** | 0.11 | 0.11 | - | 0.08 | 0.08 | 0.08 | - | - | 0.02 | 0.02 | - |
| | **7** | 0.1 | 0.1 | - | 0.04 | 0.04 | 0.04 | - | - | 0.04 | 0.04 | - |
| | **8+** | 0.17 | 0.17 | - | 0.14 | 0.14 | 0.14 | - | - | 0.05 | 0.05 | - |
| | **TFR** | **2.71** | **2.8** | **-0.09** | **2.69** | **3.04** | **2.79** | **-0.35** | **-0.11** | **2.05** | **2.38** | **-0.33** |
| **Central** | **1** | 0.74 | 0.79 | -0.06 | 0.87 | 0.96 | 0.93 | -0.09 | -0.07 | 0.74 | 0.82 | -0.08 |
| | **2** | 0.64 | 0.75 | -0.11 | 0.78 | 0.82 | 0.92 | -0.04 | -0.14 | 0.64 | 0.67 | -0.03 |
| | **3** | 0.44 | 0.5 | -0.06 | 0.45 | 0.58 | 0.51 | -0.13 | -0.06 | 0.36 | 0.47 | -0.1 |
| | **4** | 0.24 | 0.28 | -0.04 | 0.21 | 0.32 | 0.25 | -0.11 | -0.03 | 0.16 | 0.24 | -0.08 |
| | **5** | 0.13 | 0.13 | - | 0.11 | 0.11 | 0.11 | - | - | 0.07 | 0.07 | - |
| | **6** | 0.1 | 0.1 | - | 0.06 | 0.06 | 0.06 | - | - | 0.04 | 0.04 | - |
| | **7** | 0.06 | 0.06 | - | 0.02 | 0.02 | 0.02 | - | - | 0.05 | 0.05 | - |
| | **8+** | 0.15 | 0.15 | - | 0.04 | 0.04 | 0.04 | - | - | 0.02 | 0.02 | - |
| | **TFR** | **2.51** | **2.77** | **-0.27** | **2.55** | **2.92** | **2.85** | **-0.37** | **-0.3** | **2.09** | **2.38** | **-0.3** |
| **South** | **1** | 0.65 | 0.73 | -0.08 | 0.85 | 0.82 | 0.95 | 0.03 | -0.1 | 0.72 | 0.7 | 0.02 |
| | **2** | 0.62 | 0.63 | -0.01 | 0.68 | 0.73 | 0.69 | -0.05 | -0.01 | 0.62 | 0.67 | -0.05 |
| | **3** | 0.42 | 0.54 | -0.12 | 0.47 | 0.6 | 0.6 | -0.13 | -0.13 | 0.42 | 0.53 | -0.12 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **4** | 0.28 | 0.43 | -0.15 | 0.24 | 0.25 | 0.37 | -0.01 | -0.13 | 0.23 | 0.24 | -0.01 |
| | **5** | 0.16 | 0.16 | - | 0.13 | 0.13 | 0.13 | - | - | 0.12 | 0.12 | - |
| | **6** | 0.13 | 0.13 | - | 0.09 | 0.09 | 0.09 | - | - | 0.07 | 0.07 | - |
| | **7** | 0.08 | 0.08 | - | 0.06 | 0.06 | 0.06 | - | - | 0.05 | 0.05 | - |
| | **8+** | 0.11 | 0.11 | - | 0.08 | 0.08 | 0.08 | - | - | 0.08 | 0.08 | - |
| | **TFR** | **2.45** | **2.8** | **-0.35** | **2.59** | **2.75** | **2.96** | **-0.16** | **-0.37** | **2.32** | **2.46** | **-0.15** |
| **East** | **1** | 0.64 | 0.74 | -0.1 | 0.72 | 0.69 | 0.84 | 0.03 | -0.12 | 0.67 | 0.65 | 0.03 |
| | **2** | 0.6 | 0.64 | -0.04 | 0.69 | 0.69 | 0.74 | 0 | -0.05 | 0.64 | 0.64 | 0 |
| | **3** | 0.55 | 0.69 | -0.13 | 0.64 | 0.7 | 0.79 | -0.06 | -0.15 | 0.58 | 0.64 | -0.06 |
| | **4** | 0.45 | 0.44 | 0.01 | 0.49 | 0.61 | 0.48 | -0.12 | 0.01 | 0.45 | 0.56 | -0.11 |
| | **5** | 0.4 | 0.4 | - | 0.36 | 0.36 | 0.36 | - | - | 0.36 | 0.36 | - |
| | **6** | 0.42 | 0.42 | - | 0.3 | 0.3 | 0.3 | - | - | 0.3 | 0.3 | - |
| | **7** | 0.34 | 0.34 | - | 0.31 | 0.31 | 0.31 | - | - | 0.21 | 0.21 | - |
| | **8+** | 0.9 | 0.9 | - | 0.83 | 0.83 | 0.83 | - | - | 0.69 | 0.69 | - |
| | **TFR** | **4.3** | **4.57** | **-0.27** | **4.34** | **4.49** | **4.65** | **-0.15** | **-0.31** | **3.9** | **4.04** | **-0.14** |
| **Urban native** | **1** | 0.82 | 0.9 | -0.08 | 0.79 | 0.86 | 0.87 | -0.07 | -0.08 | 0.67 | 0.73 | -0.06 |
| | **2** | 0.66 | 0.72 | -0.06 | 0.67 | 0.7 | 0.73 | -0.04 | -0.06 | 0.59 | 0.62 | -0.03 |
| | **3** | 0.33 | 0.37 | -0.04 | 0.33 | 0.45 | 0.37 | -0.12 | -0.04 | 0.3 | 0.41 | -0.11 |
| | **4** | 0.19 | 0.21 | -0.01 | 0.16 | 0.27 | 0.18 | -0.11 | -0.01 | 0.11 | 0.19 | -0.08 |
| | **5** | 0.11 | 0.11 | - | 0.07 | 0.07 | 0.07 | - | - | 0.06 | 0.06 | - |
| | **6** | 0.08 | 0.08 | - | 0.04 | 0.04 | 0.04 | - | - | 0.05 | 0.05 | - |
| | **7** | 0.05 | 0.05 | - | 0.04 | 0.04 | 0.04 | - | - | 0.03 | 0.03 | - |
| | **8+** | 0.09 | 0.09 | - | 0.06 | 0.06 | 0.06 | - | - | 0.04 | 0.04 | - |
| | **TFR** | **2.33** | **2.53** | **-0.19** | **2.16** | **2.5** | **2.35** | **-0.34** | **-0.19** | **1.84** | **2.12** | **-0.28** |
| **Urban to rural** | **1** | 0.75 | 0.82 | -0.07 | 0.94 | 0.77 | 1.03 | 0.16 | -0.09 | 0.98 | 0.81 | 0.17 |
| | **2** | 0.68 | 0.71 | -0.02 | 0.99 | 0.66 | 1.02 | 0.32 | -0.03 | 0.79 | 0.53 | 0.26 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **3** | 0.42 | 0.51 | -0.09 | 0.58 | 1.11 | 0.7 | -0.53 | -0.12 | 0.78 | 1.48 | -0.7 |
| | **4** | 0.4 | 0.34 | 0.06 | 0.4 | 0.54 | 0.34 | -0.14 | 0.06 | 0.3 | 0.41 | -0.11 |
| | **5** | 0.2 | 0.2 | - | 0.28 | 0.28 | 0.28 | - | - | 0.16 | 0.16 | - |
| | **6** | 0.21 | 0.21 | - | 0.14 | 0.14 | 0.14 | - | - | 0.09 | 0.09 | - |
| | **7** | 0.07 | 0.07 | - | 0.17 | 0.17 | 0.17 | - | - | 0.06 | 0.06 | - |
| | **8+** | 0.52 | 0.52 | - | 0.33 | 0.33 | 0.33 | - | - | 0.21 | 0.21 | - |
| | **TFR** | **3.26** | **3.38** | **-0.12** | **3.82** | **4** | **4** | **-0.18** | **-0.18** | **3.36** | **3.74** | **-0.38** |
| **Rural native** | **1** | 0.6 | 0.72 | -0.11 | 0.78 | 0.73 | 0.93 | 0.05 | -0.15 | 0.63 | 0.59 | 0.04 |
| | **2** | 0.62 | 0.66 | -0.04 | 0.67 | 0.77 | 0.71 | -0.1 | -0.04 | 0.6 | 0.69 | -0.09 |
| | **3** | 0.42 | 0.5 | -0.08 | 0.5 | 0.56 | 0.59 | -0.06 | -0.1 | 0.44 | 0.49 | -0.05 |
| | **4** | 0.3 | 0.36 | -0.07 | 0.32 | 0.4 | 0.39 | -0.08 | -0.07 | 0.36 | 0.45 | -0.09 |
| | **5** | 0.24 | 0.24 | - | 0.22 | 0.22 | 0.22 | - | - | 0.2 | 0.2 | - |
| | **6** | 0.2 | 0.2 | - | 0.16 | 0.16 | 0.16 | - | - | 0.13 | 0.13 | - |
| | **7** | 0.17 | 0.17 | - | 0.12 | 0.12 | 0.12 | - | - | 0.13 | 0.13 | - |
| | **8+** | 0.39 | 0.39 | - | 0.3 | 0.3 | 0.3 | - | - | 0.29 | 0.29 | - |
| | **TFR** | **2.95** | **3.25** | **-0.3** | **3.07** | **3.26** | **3.43** | **-0.19** | **-0.36** | **2.78** | **2.97** | **-0.19** |
| **Rural to urban** | **1** | 0.75 | 0.69 | 0.06 | 0.97 | 1 | 0.9 | -0.03 | 0.07 | 0.97 | 1 | -0.03 |
| | **2** | 0.66 | 0.6 | 0.07 | 0.83 | 0.89 | 0.75 | -0.06 | 0.08 | 0.78 | 0.84 | -0.06 |
| | **3** | 0.44 | 0.41 | 0.03 | 0.49 | 0.53 | 0.45 | -0.04 | 0.04 | 0.51 | 0.56 | -0.05 |
| | **4** | 0.21 | 0.23 | -0.02 | 0.23 | 0.22 | 0.25 | 0.01 | -0.02 | 0.25 | 0.23 | 0.02 |
| | **5** | 0.12 | 0.12 | - | 0.12 | 0.12 | 0.12 | - | - | 0.14 | 0.14 | - |
| | **6** | 0.09 | 0.09 | - | 0.11 | 0.11 | 0.11 | - | - | 0.09 | 0.09 | - |
| | **7** | 0.08 | 0.08 | - | 0.06 | 0.06 | 0.06 | - | - | 0.06 | 0.06 | - |
| | **8+** | 0.13 | 0.13 | - | 0.13 | 0.13 | 0.13 | - | - | 0.11 | 0.11 | - |
| | **TFR** | **2.49** | **2.35** | **0.14** | **2.95** | **3.06** | **2.77** | **-0.12** | **0.17** | **2.93** | **3.04** | **-0.11** |
| **Turkish** | **1** | 0.76 | 0.83 | -0.06 | 0.83 | 0.89 | 0.9 | -0.05 | -0.07 | 0.71 | 0.75 | -0.05 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2** | 0.63 | 0.68 | -0.04 | 0.7 | 0.76 | 0.75 | -0.06 | -0.05 | 0.61 | 0.66 | -0.05 |
| | **3** | 0.37 | 0.43 | -0.06 | 0.36 | 0.44 | 0.43 | -0.07 | -0.06 | 0.36 | 0.44 | -0.07 |
| | **4** | 0.19 | 0.24 | -0.05 | 0.16 | 0.22 | 0.2 | -0.05 | -0.04 | 0.16 | 0.22 | -0.05 |
| | **5** | 0.11 | 0.11 | - | 0.08 | 0.08 | 0.08 | - | - | 0.06 | 0.06 | - |
| | **6** | 0.07 | 0.07 | - | 0.06 | 0.06 | 0.06 | - | - | 0.03 | 0.03 | - |
| | **7** | 0.06 | 0.06 | - | 0.02 | 0.02 | 0.02 | - | - | 0.03 | 0.03 | - |
| | **8+** | 0.1 | 0.1 | - | 0.06 | 0.06 | 0.06 | - | - | 0.02 | 0.02 | - |
| | **TFR** | **2.3** | **2.51** | **-0.21** | **2.29** | **2.53** | **2.5** | **-0.24** | **-0.22** | **1.98** | **2.21** | **-0.23** |
| **Kurdish** | **1** | 0.58 | 0.87 | -0.29 | 0.74 | 0.67 | 1.11 | 0.07 | -0.37 | 0.71 | 0.65 | 0.06 |
| | **2** | 0.65 | 0.75 | -0.1 | 0.68 | 0.72 | 0.78 | -0.04 | -0.1 | 0.68 | 0.72 | -0.04 |
| | **3** | 0.54 | 0.69 | -0.15 | 0.58 | 0.57 | 0.73 | 0 | -0.16 | 0.5 | 0.5 | 0 |
| | **4** | 0.54 | 0.63 | -0.08 | 0.53 | 0.51 | 0.61 | 0.02 | -0.08 | 0.45 | 0.43 | 0.02 |
| | **5** | 0.47 | 0.47 | - | 0.34 | 0.34 | 0.34 | - | - | 0.43 | 0.43 | - |
| | **6** | 0.51 | 0.51 | - | 0.29 | 0.29 | 0.29 | - | - | 0.38 | 0.38 | - |
| | **7** | 0.4 | 0.4 | - | 0.35 | 0.35 | 0.35 | - | - | 0.31 | 0.31 | - |
| | **8+** | 1.11 | 1.11 | - | 0.79 | 0.79 | 0.79 | - | - | 0.91 | 0.91 | - |
| | **TFR** | **4.81** | **5.43** | **-0.62** | **4.3** | **4.24** | **5.01** | **0.05** | **-0.71** | **4.37** | **4.32** | **0.04** |
| **Other** | **1** | 0.64 | 0.44 | 0.2 | 0.63 | 0.99 | 0.44 | -0.35 | 0.2 | 0.88 | 1.37 | -0.49 |
| | **2** | 0.64 | 0.67 | -0.03 | 0.92 | 1.25 | 0.96 | -0.32 | -0.04 | 0.75 | 1.01 | -0.26 |
| | **3** | 0.32 | 0.23 | 0.09 | 0.84 | 1.17 | 0.61 | -0.32 | 0.23 | 0.33 | 0.45 | -0.13 |
| | **4** | 0.26 | 0.29 | -0.04 | 0.71 | 0.45 | 0.81 | 0.25 | -0.1 | 0.31 | 0.2 | 0.11 |
| | **5** | 0.19 | 0.19 | - | 0.33 | 0.33 | 0.33 | - | - | 0.19 | 0.19 | - |
| | **6** | 0.18 | 0.18 | - | 0.26 | 0.26 | 0.26 | - | - | 0.14 | 0.14 | - |
| | **7** | 0.09 | 0.09 | - | 0.25 | 0.25 | 0.25 | - | - | 0.11 | 0.11 | - |
| | **8+** | 0.27 | 0.27 | - | 0.46 | 0.46 | 0.46 | - | - | 0.34 | 0.34 | - |
| | **TFR** | **2.57** | **2.35** | **0.22** | **4.42** | **5.16** | **4.12** | **-0.75** | **0.29** | **3.05** | **3.81** | **-0.77** |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **No education/ primary incomplete** | **1** | 0.69 | 0.74 | -0.05 | 0.73 | 0.76 | 0.77 | -0.04 | -0.05 | 0.66 | 0.69 | -0.03 |
| | **2** | 0.75 | 0.84 | -0.09 | 0.68 | 0.74 | 0.76 | -0.06 | -0.08 | 0.69 | 0.76 | -0.06 |
| | **3** | 0.62 | 0.68 | -0.06 | 0.71 | 0.68 | 0.77 | 0.02 | -0.06 | 0.56 | 0.54 | 0.02 |
| | **4** | 0.46 | 0.54 | -0.07 | 0.58 | 0.6 | 0.67 | -0.01 | -0.09 | 0.51 | 0.52 | -0.01 |
| | **5** | 0.37 | 0.37 | - | 0.38 | 0.38 | 0.38 | - | - | 0.42 | 0.42 | - |
| | **6** | 0.33 | 0.33 | - | 0.28 | 0.28 | 0.28 | - | - | 0.33 | 0.33 | - |
| | **7** | 0.24 | 0.24 | - | 0.22 | 0.22 | 0.22 | - | - | 0.28 | 0.28 | - |
| | **8+** | 0.46 | 0.46 | - | 0.46 | 0.46 | 0.46 | - | - | 0.53 | 0.53 | - |
| | **TFR** | **3.92** | **4.19** | **-0.27** | **4.03** | **4.12** | **4.32** | **-0.09** | **-0.28** | **3.97** | **4.06** | **-0.09** |
| **First level primary** | **1** | 0.76 | 0.79 | -0.03 | 0.89 | 0.81 | 0.92 | 0.07 | -0.03 | 0.82 | 0.75 | 0.07 |
| | **2** | 0.68 | 0.75 | -0.07 | 0.78 | 0.76 | 0.86 | 0.02 | -0.08 | 0.74 | 0.72 | 0.02 |
| | **3** | 0.4 | 0.45 | -0.05 | 0.44 | 0.46 | 0.49 | -0.02 | -0.05 | 0.49 | 0.52 | -0.02 |
| | **4** | 0.22 | 0.22 | -0.01 | 0.19 | 0.21 | 0.19 | -0.03 | -0.01 | 0.22 | 0.26 | -0.03 |
| | **5** | 0.09 | 0.09 | - | 0.1 | 0.1 | 0.1 | - | - | 0.08 | 0.08 | - |
| | **6** | 0.05 | 0.05 | - | 0.06 | 0.06 | 0.06 | - | - | 0.03 | 0.03 | - |
| | **7** | 0.03 | 0.03 | - | 0.03 | 0.03 | 0.03 | - | - | 0.02 | 0.02 | - |
| | **8+** | 0.04 | 0.04 | - | 0.03 | 0.03 | 0.03 | - | - | 0.02 | 0.02 | - |
| | **TFR** | **2.28** | **2.43** | **-0.15** | **2.51** | **2.46** | **2.68** | **0.05** | **-0.17** | **2.44** | **2.4** | **0.04** |
| **Second level primary or higher** | **1** | 0.83 | 0.85 | -0.02 | 0.77 | 0.79 | 0.79 | -0.02 | -0.02 | 0.73 | 0.75 | -0.02 |
| | **2** | 0.64 | 0.48 | 0.16 | 0.68 | 0.7 | 0.51 | -0.02 | 0.17 | 0.55 | 0.57 | -0.02 |
| | **3** | 0.2 | 0.19 | 0 | 0.2 | 0.35 | 0.19 | -0.15 | 0 | 0.2 | 0.35 | -0.16 |
| | **4** | 0.05 | 0.06 | -0.01 | 0.08 | 0.12 | 0.11 | -0.04 | -0.02 | 0.05 | 0.07 | -0.02 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **5** | 0.01 | 0.01 | - | 0.01 | 0.01 | 0.01 | - | - | 0.01 | 0.01 | - |
| | **6** | 0 | 0 | - | 0 | 0 | 0 | - | - | 0 | 0 | - |
| | **7** | 0 | 0 | - | 0 | 0 | 0 | - | - | 0 | 0 | - |
| | **8+** | 0 | 0 | - | 0 | 0 | 0 | - | - | 0.01 | 0.01 | - |
| | **TFR** | **1.72** | **1.59** | **0.13** | **1.73** | **1.97** | **1.61** | **-0.24** | **0.13** | **1.54** | **1.76** | **-0.22** |
| **Turkey** | **1** | 0.74 | 0.8 | -0.06 | 0.81 | 0.85 | 0.88 | -0.04 | -0.07 | 0.72 | 0.75 | -0.03 |
| | **2** | 0.64 | 0.69 | -0.05 | 0.71 | 0.77 | 0.77 | -0.06 | -0.06 | 0.63 | 0.68 | -0.05 |
| | **3** | 0.39 | 0.45 | -0.05 | 0.41 | 0.49 | 0.47 | -0.08 | -0.05 | 0.39 | 0.46 | -0.07 |
| | **4** | 0.24 | 0.28 | -0.04 | 0.23 | 0.27 | 0.27 | -0.04 | -0.04 | 0.21 | 0.25 | -0.04 |
| | **5** | 0.15 | 0.15 | - | 0.13 | 0.13 | 0.13 | - | - | 0.12 | 0.12 | - |
| | **6** | 0.12 | 0.12 | - | 0.1 | 0.1 | 0.1 | - | - | 0.08 | 0.08 | - |
| | **7** | 0.1 | 0.1 | - | 0.07 | 0.07 | 0.07 | - | - | 0.06 | 0.06 | - |
| | **8+** | 0.21 | 0.21 | - | 0.15 | 0.15 | 0.15 | - | - | 0.13 | 0.13 | - |
| | **TFR** | **2.59** | **2.8** | **-0.21** | **2.62** | **2.83** | **2.83** | **-0.21** | **-0.22** | **2.33** | **2.53** | **-0.19** |

**The calculations are based on the time period approach of Bongaarts (1999), the details of which can be found in Chapter 2.*

****The calculations are based on the time period approach of Lesthaeghe and Willems (1999), the details of which can be found in Chapter 2.*