

# Methodological analysis of period fertility in Saudi Arabia 2018

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## Research Article

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# Abstract

Exact measurement and evaluation of indicators of period fertility in a multiracial society could help explaining disparities. This paper represents a methodological and analytical attempt to systematically analyze period fertility and discuss differentials in its level and pattern between domestic and expatriate women in Saudi Arabia as far as available data allow. The data used are obtained from official Sources published by General Authority for Statistics in the Household Health Survey 2018. Estimated period fertility indicators, started from the simplest rates to the more elegant ones with adequate illustration of the advantages and disadvantages of each of them. The purpose was to establish fertility differentials and historical pattern. The paper has consistently shown that the fertility of expatriates in Saudi Arabia is lower than the fertility of the Saudi domestic women, but the reason for the disparity was not established as contraceptive practice has not confirmed sufficient influence. It was also revealed that the fertility transition that had been taking place since early eighties will continue but it will have precautions in the future.

## Background

In demography the word fertility means the number of live births a woman achieves during her lifetime. Of course, in Muslim countries, this entails the institution of marriage. Fertility is different conceptually from fecundability which means that a woman is biologically capable to produce children but for one reason or another she is not fertile. Thus, precise measurement of period fertility for any population is very crucial, perhaps to two decimal places, before any attempt to analyze its determinants is made. In Saudi Arabia all measures of fertility are available, but with different methodologies and varying accuracy. In this paper we attempt to provide systematic measurement of period fertility to two decimal places for all rates and explain the conceptual meaning of these rates in scholarly way. This is done for both domestic Saudi women and for non-Saudi women residents and the tempo of period fertility is considered. Also, historical pattern of period fertility is analyzed and comparisons as to the practice of family planning by the two populations groups are investigated.

## Material And Method

This study depends entirely on secondary data officially published by the Saudi General Authority for Statistics with special reference to the tables provided by the Household Health Survey 2018. The tables on which our analysis is based are:

- Total Population in Saudi Arabia.
- Saudi and non-Saudi Age and sex distribution.
- Age Specific Fertility Rates in Saudi Arabia.
- Total fertility by administrative regions in Saudi Arabia.

- Contraceptive prevalence among females in reproductive ages.

The study focuses on period fertility alone because the Household Health Survey 2018 does not provide data on cohort fertility. We attempt to introduce period measures of fertility in a systematic way starting from crude measures to more refined ones, indicating measurement methodology and the pros and cons of each. And discuss the disparities between rates for Saudis and non-Saudis and the role of contraceptive use in influencing these disparities.

### **Conceptuality of fertility indicators in demographic literature**

Fertility is different conceptually from fecundability which means that a woman is biologically capable to produce children but, for some reason, she is not fertile. From the experience of human populations, the maximum number of children per woman is about 17 births on average, if no fertility control is ever practiced. However, no population ever recorded this figure and the maximum number of children recorded has never surpassed 15 children or dropped below 0.83 children. Thus, precise measurement of period fertility for any population is very crucial.

Demographers differentiate conceptually between a ratio and a rate. According to (Newell, 1988, p.6)) “a ratio is simply any number divided by any other number”. For instance, the dependency ratio equals the total of young and old people divided by the working population multiplied by 100. The rate, on the other hand, resembles the way in which a certain event occurs in a specified period of time, thus entailing the definition of exposure years to the forces of that event. The grasp of a period rate, therefore, involves some imagination because it is synthetic rather than real. For example, as we shall see later in this paper, total fertility rate is an imaginative concept of fertility performance of a cohort of women as they produce children along a historical age scale; if they live and follow the same natality regime (Shryock and Seigel, 1976:287).

Even more imaginative is the concept of “Persons Years” that is frequently used by demographers. For example, as women proceed in life and give birth, some of them die in the process; and since they contribute to fertility at each age their exact years of survival at age group must be considered which, although important, is usually difficult to grasp, instead demographers use the concept of “Mid-Year” as a proxy for the total women in in age group. More detailed explanation of Mid-Year concept is found in (Alnory and Al Farouk, 2000).

The Growth Reproduction Rate GRR and Net Reproduction Rate NNR, are also synthetic measures and more imaginative than total fertility. The two measures represent what is called in demography “reproductivity” It refers to the concept of replacement in dealing with female births rather than all births. Two very important concepts are also related to these two measures: these are the mean age of fertility distribution and the mean age of childbearing, which are not similar.

One concept which is frequently used is that of fecundability. This relates to the physiological ability to conceive i.e., the statistical probability of conception in a menstrual cycle. It is particularly important in

the statistical modeling of the process of family building, and in estimation of the effectiveness of family planning programmers. (Newell, 1988)

Population in which no deliberate attempt is made to limit the number of births is said to experience “natural fertility”. This very important and widely used concept was first identified and named by Louis Henry (1961, 1972a). Such measure of fertility is a biological indicator and its magnitude depends on social norms as related to family planning, breastfeeding and weaning practices. There is no fertility limiting behavior which is in any way dependent on the number of children already born (Newell, 1988:35).

## Period Measures of Fertility in Saudi Arabia 2018

### ●- The Child/Woman Ratio

This is defined as:

$$\text{C/W Ratio} = \frac{\text{Children age 0-4}}{\text{woman aged 15-49}}$$

From appendix table 1, 2, 3 (Saudi Population by Age Groups and sex) C/W ratios are calculated in table (2) below.

**Table (1): Child/Woman Ratio in Saudi Arabia**

Population	C/W
Saudi Women	0.3897
Non-Saudi Women	0.2105
Total Women in Saudi Arabia	0.3576

*Source: Household Health Survey, Saudi Arabia, 2018*

It is clear that C/W ratio is higher for Saudi women than that for non-Saudi women but the ratio for both is low compared to Arab and Asian countries. The usefulness of the ratio, however, arises from the fact that it requires only information on the composition of the population by age and sex. No data on births are needed at all. This makes it particularly useful when using census data. Obviously, it is an extremely crude measure, but, broadly, if fertility is high, the Child/Woman Ratio will be high, while if fertility is low, the ratio will be low. It is, however, quite sensitive to reporting errors and to the level of infant mortality, so it is dangerous to use the ratio to compare populations with substantially different levels of infant and child mortality, or where under reporting of young children is a problem.

### ●-The crude Birth Rate:

$$CBR = \frac{\text{Births in year}}{\text{Population at mid-year}} * 1000$$

This is a simple and notorious indicator judging from the following equation

From table 1, 2, 3 Household Health Survey, Saudi Arabia, 2018 (Saudi Population by Age Groups and sex) Crude birth Rates are calculated in table (2) below.

**Table (2): Crude Birth Rates**

Population	C/W
Saudi Women	17.9
Non-Saudi Women	8.2
Total Women in Saudi Arabia	14.3

Source: Household Health Survey, Saudi Arabia, 2018

Once again there is a marked differential between national Saudi women and expatriate women. The range CBR that has been observed in human population is between 10 and 50, thus the rate for national Saudi woman is slightly above the international average, while it is below the international average for non-Saudi women.

The inclusion of all ages and sex makes the measure crude. Comparisons are not logical as births are not related to females at risk. But three reasons are usually cited for its importance. First, it is easy to grasp. Second, data requirement and calculations are simple because what we need are total population and one year's birth. Third, if one subtracts the CDR from the CBR, he gets what is called the rate of natural increase. To see the usefulness of the CBR consider the location of Saudi Arabia in the international fertility regimes portrayed in figure 1. It is clear that CBR for non-Saudi women is closer to the world minimum, while that for Saudi women is towards the world maximum.

- **Age-Specific Fertility Rate (ASFR)**

The definition of ASFR is:

$$ASFR = \frac{\text{Births in year to women aged } x}{\text{Women aged } x \text{ at mid-year}}$$

Often, though, ASFR are calculated per thousand women; and seven rates are calculated as in Table 3, but single-year rates are also common. Here they are calculated per woman. Note there is a big jump in data requirements. Specific fertility rates are given in the Household Health Survey of Saudi Arabia in 2018 for Saudi women and total women, but it is easy to observe that the lower series of ASFR for total Saudi women is an indication of lower fertility among non-Saudi women. As reflected in the

Child/Women ratio and the crude birth rate previously, age specific fertility rates for total women are lower at all ages than those for Saudi women. However, although the age specific fertility distributions for Saudi and non-Saudi women are different in level, they look similar in pattern. Both distributions have a late peak indicating that Saudi and non- Saudi women achieve 50% percent of their fertility by age 31 approximately with similar dispersion. See Fig (2).

**Table (3): ASFRs for total and Saudi**

Age groups	ASFR for Saudi Women	ASFR for Total women
15 - 19	0.0076	0.007384
20 - 24	0.0615	0.066228
25 - 29	0.1113	0.099686
30 - 34	0.1244	0.104826
35 - 39	0.1091	0.073272
40 - 44	0.0421	0.02569
45 - 49	0.0097	0.007149

*Source: Household Health Survey, Saudi Arabia, 2018*

As reflected in Fig. (3) ASFR is lower for total women than for Saudi women in all age groups, except, perhaps the younger age groups 15-19 and 20-24, but the shapes of the two curves are astonishingly identical. They tend to show regular features: a rapid rise to a peak in the early or mid-twenties and a gradual decline to very low levels after age 40. These regularities make ASFRs amenable to mathematical modeling.

The major inconvenience of ASFRs stems from the fact that they are not single numbers but a set of seven rates. As such, comparisons become a little complex. Fortunately, this problem can be overcome by summarizing them by using Total Fertility Rate.

- **-Total Fertility Rate (TFR)**

Sometimes, this is called a Total Period Fertility Rate (TPFR), TFR is mathematical sum of ASFRs. There are some complications relating to the average of the age interval. Thus, it is necessary to multiply the five-year rate by five. Second, the TFR is almost always expressed per one woman, whereas ASFRs are often expressed per 1,000. If that is the case, then it is necessary to divide by 1,000.

The formula is thus:

$$\mathbf{TPFR = \frac{Sum\ of\ ASFRs * 5}{1,000}}$$

Total fertility rates for Saudi and total women are calculated from table 3 as 2.33 and 1.92 respectively. It becomes very clear now that the fertility of indigenous Saudi women is higher than that of expatriate women by 0.41 children per woman. This is a very high differential because for every 1000 women, Saudi females have 410 children more than non-Saudi women. Before we discuss the reasons for such huge disparity, we first look at variation of TFR by region in Saudi Arabia.

As can be seen in Fig. (3) below, TFR for the total women is consistently lower than that of Saudi women, an indication that expatriate women have lower total fertility. If TFR=2 is taken as a cutoff point, we notice that in all regions TFR of Saudi women is greater than 2.0 except in Jazan, Al-Baha and Al-Jouf, On the other side, TFR for total is lower than 2 for all regions except Tabuk, Northern Borders and Najran.

- **-Measures of Reproductively**

Reproductively considers the extent to which one generation of females reproduces itself. It deals with two important period measures of fertility, that is, the Gross and Net reproduction rates and also two-time location period measures of fertility, the mean of the age-specific fertility distribution and the mean age of childbearing.

### The Gross Reproduction Rate (GRR)

This measure is very similar to the Total Fertility Rate (TFR) except that it considers only female rather than all births. It is calculated in the same way as the TFR but uses female age-specific fertility rates. As shown in table (4), GRR for Saudi women is 1.14,  $(0.2271 \times 5)$  children per woman.

Table (4) Gross and Net Reproduction Rates for Saudi females

Age group	Saudi Females ASFRs	Exact Age	$l_x$	$L_{x5}$	Female birth in the stationary Population	Mid-point of age group	Average female birth	Average female birth in the stationary population
(1)	(2)	(3)	(4)	(5)	(6) = (2)x(5)	(7)	(8) = (2)x(7)	(9) = (6)x(7)
15 - 19	0.0037	15	0.9991	4.995	0.0185	17.5	0.0648	0.324
20 - 24	0.0300	20	0.9989	4.965	0.1489	22.5	0.675	3.35
25 - 29	0.0543	25	0.9871	4.911	0.2667	27.5	1.468	7.334
30 - 34	0.0607	30	0.9774	4.867	0.2954	32.5	1.973	9.6
35 - 39	0.0532	35	0.9695	4.967	0.2642	37.5	1.995	9.907
40 - 44	0.0205	40	0.9091	4.318	0.0885	42.5	0.871	3.761
45 - 49	0.0047	45	0.8183	-	-	47.5	0.223	-
<b>Total</b>	<b>0.2271</b>				<b>1.0822</b>		<b>7.2698</b>	<b>34.276</b>

*Source: Household Health Survey, Saudi Arabia, 2018*

The Gross Reproduction Rate is understood as the average number of female births given to a woman who reaches age fifty with constant ASFRs. Remember that GRR, like the TFR, is a period rate and therefore it has nothing to do with any real cohort. Instead, it considers a hypothetical, synthetic cohort as illustrated earlier. A GRR= 1.0 means that women are approximately replacing themselves, while a GRR= 2.0 may be taken to imply that the population is doubling itself in a generation; that is, each woman is producing, on average, two daughters. However, it is important to be very careful in the interpretation of the GRR, not only because it is a period measure, but also because it does not consider mortality between ages 15 to 50. Thus, a GRR > 1.0 is essential for a woman to substitute herself, although this depends on the extent of mortality. The same applies to the TFR of course. A figure of over 2.0 is required to ensure that in the long term the population maintains its size.

Calculated in the same way, GRR for total women in Saudi Arabia is 0.94 children. The results suggest that every 100 Saudi women are replacing themselves by 94 daughters, while every 100 non-Saudi women are replacing themselves by only 94 daughters. This explains the differential between the two in an intrinsic way.

Obviously, all the daughters will not survive to substitute their mothers, and all mothers will not live to the end of their fertile years. This impact of mortality is controlled for in the next measure, the Net Reproduction Rate.

### **The Net Reproduction Rate (NRR)**

Basically, Net Reproduction Rate (NRR) is GRR adjusted by mortality. The adjustment is done by multiplying each ASFR for daughters by the probability of surviving to that age; and then sum and multiply by five. NRR is always slightly less than the GRR, the difference is dependent on mortality. The probability of surviving to a certain age  $x$  is referred to as  $l_x$  and so the calculation the NRR requires both female ASFRs and a life table. Not that a precise life table for female for the year in question is not essential. Any reasonable estimate is adequate. The calculation for Saudi Arabia, 2018, is shown in Table 9.2 based on a live table calculated from age specific death rates in 2017.

In table 4, NRR for Saudi females is 1.082 (Sum of column 6). The difference of 0.06 children is a result of female mortality in 2018. Calculated in the same way, NRR for total (including non-Saudi women) is 0.90. The timing of fertility of Saudi and non-Saudi women is almost the same as the mean of childbearing calculated from table 4 is nearly close for the two groups 31 and 32 years respectively. This is because, as indicated earlier, the shape of age specific fertility curves for the two is similar with moderate skewness and kurtosis.

### **Explaining the differential**

So far, the evidence points at a marked differential in the fertility performance of Saudi and non-Saudi females, indicating higher fertility levels among Saudi women. The Saudi Household Survey 2018 had not provided predisposing variables to analyze the determinants of the differential except, perhaps, one variable in that respect. This is the data relating to the prevalence of the use of modern contraceptives for Saudi currently married women and total women classified by age groups of women in the reproductive period, Table (5).

Although the table does apparently seem to support the hypothesis that family planning practice in Saudi Arabia has important role in the fertility transition that has been gaining momentum in Saudi Arabia since 1984, it does, partially, explain some effect of family planning on the fertility differential as 33% of non-Saudi women are current users of contraceptive methods compared to 30% of Saudi women.

**Table (5): Contraceptive Prevalence Rates by Age Groups**

Age group	Total Women	Saudi Women
15 - 19	15.0	12.0
20 - 24	22.4	20.7
25 - 29	31.8	32.1
30 - 34	34.6	33.6
35 - 39	36.1	33.1
40 - 44	37.8	33.1
45 - 49	24.7	21.9
Total	32.9	30.4

Although the table does support the hypothesis that family planning has a major role in the fertility transition that has been gaining momentum in Saudi Arabia since 1984, it does, partially, explain some effect of family planning on the fertility differential as 33% of non-Saudi women are current users of contraceptive methods compared to 30% of Saudi women. To investigate the root causes of the differential, one need to look into marriage patterns in the two groups, particularly age at marriage, but this is beyond the scope of this paper. However, the fact that emerged from this research so far is that total fertility for both Saudi and non-Saudi women have been declining for the last three decades.

To carry the analysis a step further, we looked at the historical pattern of the TFR for the period 1960 – 2016 provided by Saudi Household Survey 2018. Time series for Saudi-non-Saudi women are not available separately; instead they are available for Saudi total women only. Table (6) suggests that total fertility in Saudi Arabia have been declining continuously since 1983.

Comparing the fertility transition in Saudi Arabia with that of the United Kingdom and Hong Kong for the same period we notice the following:

- When fertility transition started to decline in Hong Kong and later in Saudi Arabia, the trend had already gained a great momentum in UK. The decline started in Saudi Arabia in the beginning of the eighties from a level of a little more than 7 children in 1960 to 2.3 in 2018, when at that time TFR in UK was less than 3.0.

- The transition in Hong Kong started a little earlier than 1960 but with faster pace surpassing UK transition reaching replacement level in 2018.
- The transition in UK and Hong Kong witnessed ups and downs in the process, while it was steadily decreasing in Saudi Arabia suggesting that the data for Saudi Arabia had been somewhat graduated or smoothed.
- The transition in Saudi Arabia and UK has been influenced by migrants in both countries but migrant fertility in UK is suggesting convergence with the domestic population (Sylvie Dubuc, 2009), while that of Saudi Arabia is showing the opposite as the fertility of non-Saudi women is already consistently lower than domestic women fertility.
- While further decline for domestic Saudi fertility is feasible, any further decline or transition in the fertility of non-Saudi, UK and Hong women would lead to negative trend in the population growth. This means that a "second demographic transition in these series would eventually lead to dwindling population size.

## Conclusion

The methodological study attempted in this paper to investigate period fertility in Saudi Arabia, has actually raised more questions than answers. It has been consistently shown that the fertility of expatriates in Saudi Arabia is lower than the fertility of the Saudi domestic women but the reason for the disparity was not established as contraceptive practice has not confirmed sufficient influence. The replacement level analysis told us that the population of the expatriate will be dwindling in size if the fertility continued to decline among this population category. But the fertility transition that has been taking place in Saudi Arabia is suggestive of further decline before the transition is complete. It is, however, paramount for the Saudi statistical authorities to provide needed information on predisposing variables influencing differential fertility between domestic and expatriate women, especially that the majority of expatriate women are coming from countries where fertility is exceptionally high and no evidence of transition has, so far, been noticed in these countries.

## Declarations

**Conflict of interest:** The authors declare no potential conflict of interest

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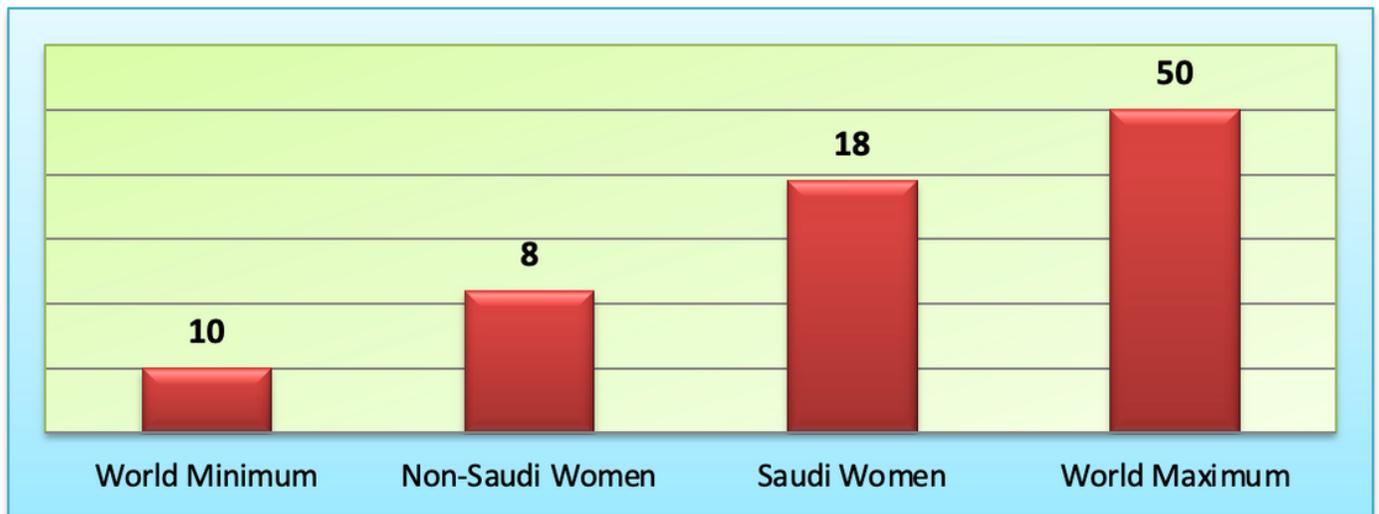
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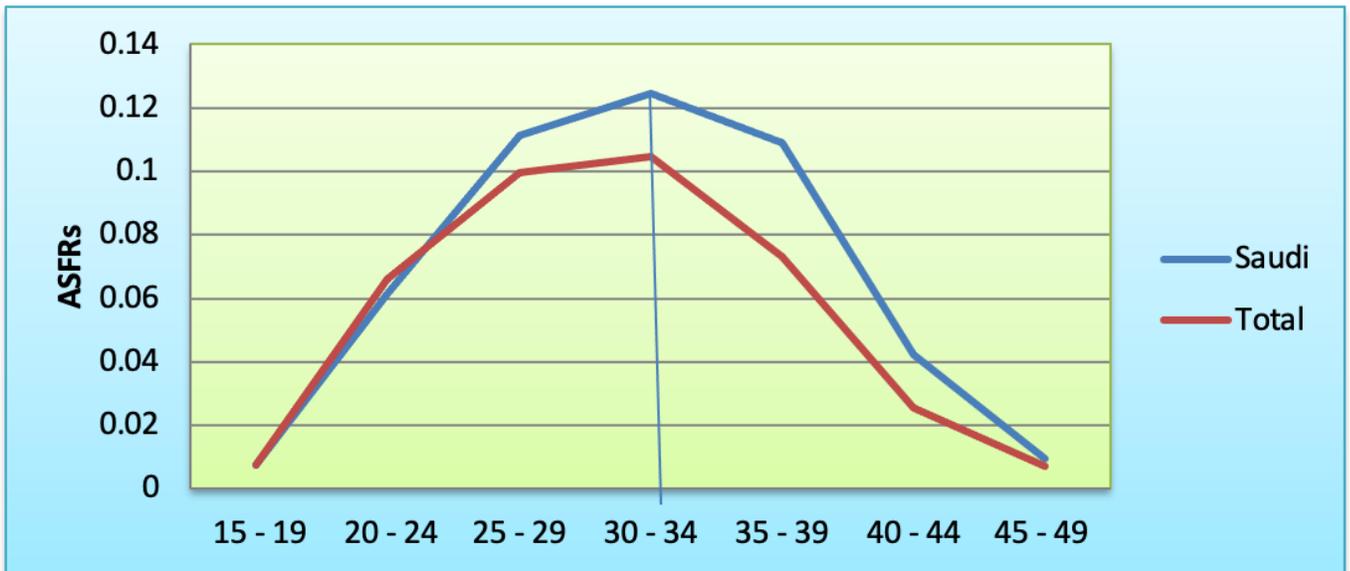
## Figures



*Source: Based on table 2*

**Figure 1**

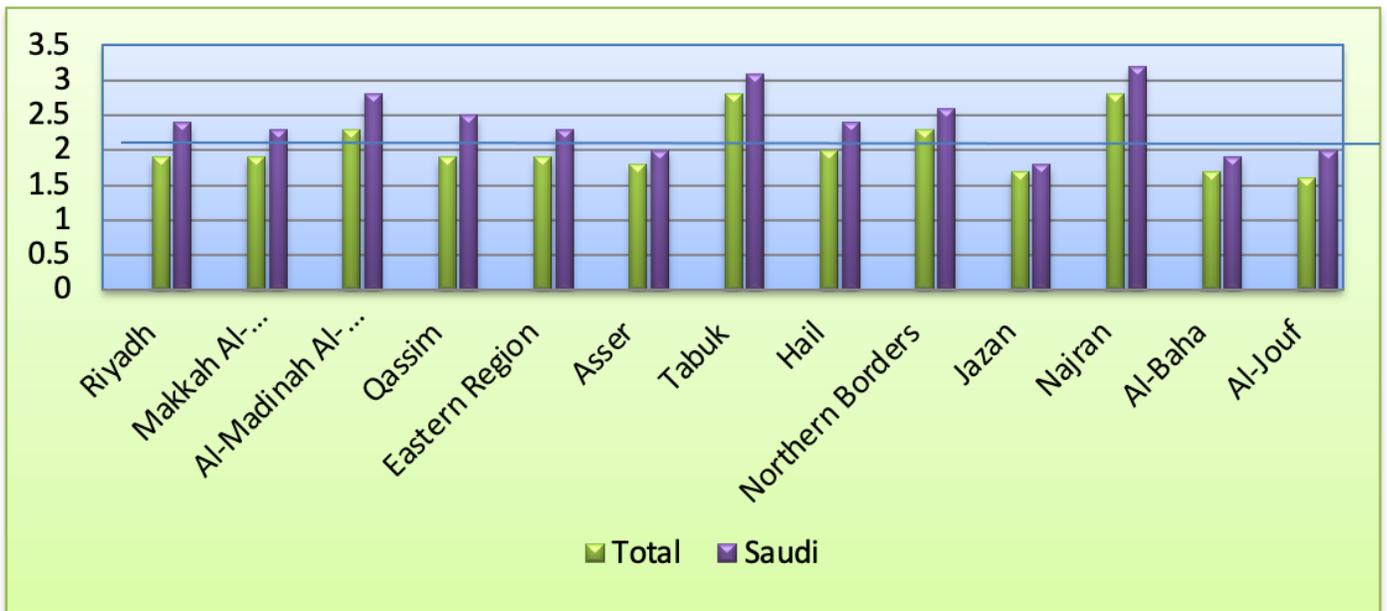
Comparisons of CBR for Saudi and non-Saudi Women with World Bounds



Source: Household Health Survey, Saudi Arabia, 2018

Figure 2

Comparisons of ASFRs for Saudi and non-Saudi Women



Source: Household Health Survey, Saudi Arabia, 2018

Figure 3

Comparisons of TFR for Saudi and non-Saudi Women by region

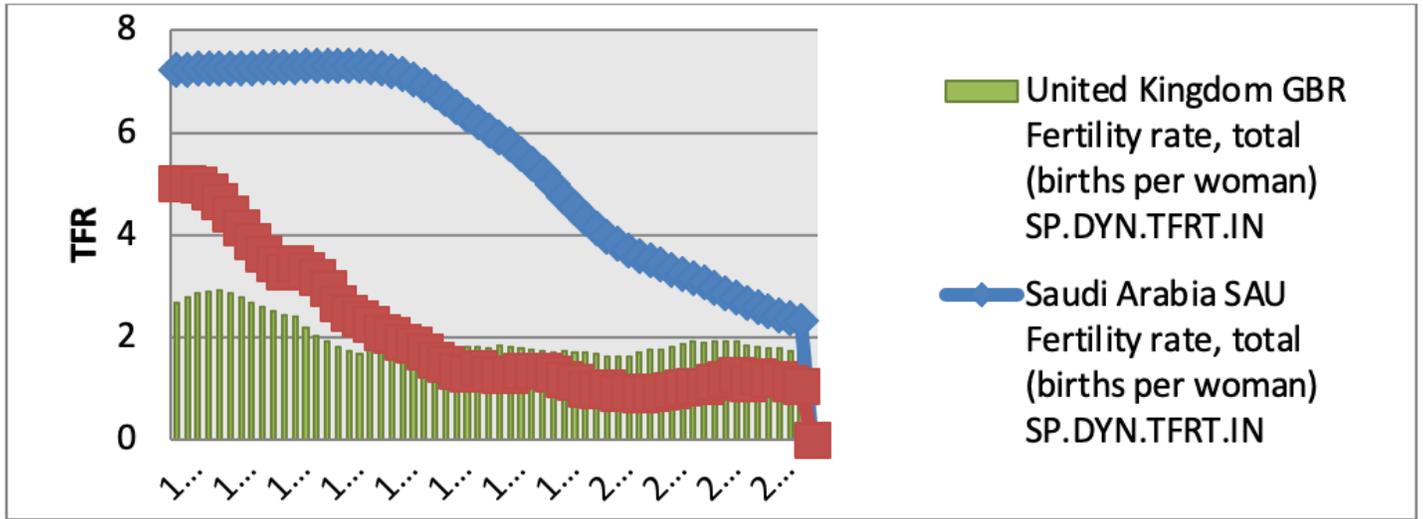


Figure 4

Fertility Transition in Saudi Arabia, UK and Hong Kong for the period 1960-2018