FACTORS DETERMINING DECLINE IN SEX RATIO IN KUWAITI POPULATION

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ABSTRACT

Census data of kuwait show that the sex ratio among kuwaiti nationals has been declining. This paper examines the influence of various factors on sex ratio. Among the 5 factors considered here, the results show that two of them, viz, the mortality differential between kuwaiti males and kuwaiti females and the mixed marriages of kuwaitis with Non-Kuwaitis, contributed towards 70 percent of decline in sex ratio during the intercensal period 1975-80. The impact of errors in census counts on sex ratio could not be precisely estimated in the absence of Post Enumeration Surveys. Further no trend in sex ratio at birth was found. The influence of birth order and maternal age on sex ratio at birth was also studied through regression analysis and by linear and quadratic models. The results are presented in the paper which suggest a non-linear relationship. The migration factor is considered not relevant for kuwaiti nationals.

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1. Introduction

Population data by sex holds a position of prime importance in demographic studies. Many types of planning, such as military planning, planning of community institutions and services, particularly health services, require separate population data by sex. The balance of the sexes exert an important influence on the marriage rates in the community. Sex Ratio, defined as number of males per 100 females, is the most widely used measure of sex composition.

2. Census Data

2.1 Census data is usually the main source of data for studying the level and trends in sex ratio for a population. Kuwait conducted the fist census in 1957 and the latest, the seventh, in April 1985. The census counts show (Table 1) that kuwaiti population has increased from 144 thousand in 1957 to 680 thousand in 1985. During these years kuwaiti male population has gone up from 59 thousand to 337 thousand and that of kuwaiti females from 54 thousand to 342 thousand. Till 1975 there were more kuwaiti males than kuwaiti females but the difference was Continuously shrinking. The excess of male population over female population came down from 7013 in 1961 to only 1112 in 1975. The last two censuses of 1980 and 1985 show that kuwaiti female population have exceeded kuwaiti male population, the excess being 4315 in 1980 and 5115 in 1985. This has resulted in the continuous decline of sex ratio from 109.1 in 1961 to 98.5 in 1985. The sex ratio remained in favour of kuwaiti males till 1975 and afterwards it shifted in favour of kuwaiti females.

2.2 The study of kuwaiti population by age and sex reveals that there were always, more females than males in the age groups (15-19) and (20-29) and this excess has been continuously increasing over time. On the other hand the excess of males over females has been consistently shrinking in the ages (30-49) years since 1970. These two striking trends in favour of female population have mainly contributed towards reducing the sex ratio in kuwaiti population. (Table 2)

2.3 The sex ratios by age for kuwaiti population from census data are shown in Table 2. Their study clearly shows that in the ages (39-49) the sex ratios, though in favour of males, were declining very sharply. For the age groups (15-19) and (20-29) years, the sex ratios have been persistently below 100 during the years 1965-1980. Though for the age-group (15-19) years, the sex ratios show a very slight upward turn, but a sharp fall in sex ratio from 99.5 in 1965 to 85.3 in 1980 is observed for the age group (20-29) years. In the age group (5-14) years, the sex ratio, though still above 100, has been falling at a moderate rate.

3. Factors Influencing Sex Ratios

3.1 The following 5 factors may be considered to influence the changes in the sex ratios in kuwaiti population :

(A) Sex differentials in errors in census counts.
(B) Migration.
(C) Sex ratio at birth
(D) Sex differential in mortality
(E) Mixed marriages

A- Errors in Census Counts

A.1 These errors concern mis-statement of age especially by female respondents, omissions and undercounts, declaration by Non-Kuwaitis as kuwaitis. In the traditional societies, a general tendency noticed among young women is to under-state their ages and among young brides 15 years to over-state their ages. The result is that sex ratios gets depressed in the early age group such as (15-19) years and later ages due to inclusion of females which do not belong to these age groups. Regarding omission and undercounts, no definite estimates are available in absence of the Post-Enumeration Surveys. There is however little likehood of large omissions due to (i) small size of the population which is concentrated in easily accessible areas and (ii) well experienced census administration machinery. There, however, exists the possibility of Non-Kuwaitis declaring themselves as Kuwaitis in the censuses where no proof of nationality was demanded. This may be more possible in case of Non-Kuwaiti females married to Kuwaitis*. So in the absence of data on errors in census counts, no definite conclusion can be drawn.

B-Migration

B.1 There may be hardly any Kuwaiti national who has permanently migrated to another country and renounced his Kuwaiti nationality. Further, as far as Kuwaiti nationals are concerned, the census counts are de jure including the Kuwait nationals who were abroad at the time of census. So migration has not played any role in the changes shown by sex ratios.

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*In 1980 census, the census enumerators were asked to see the documentary proof of nationality of the respondents

C- C- Sex Ratio at Birth

C.1 In a closed population, the age-sex distribution of the population and the sex ratios are determined by fertility and mortalitg factors alone. The study of sex ration is therefore considered very relevant in case of kuwaiti population where migration has played neglegible and insignificant role. The sex ratio at birth is defined as number of male births to per 100 female births and its value generally exceeds 100 in almost all populations and societies. year-wise values of sex ratio at birth and its standard error for kuwaiti birth over the year 1973-1984 are shown in Table 3. As may be seen, the sex ratio fluctuates between 101 and 105 during these years. The standard error of the sex ratio at birth has been calculated by using the formula*: (Pollard - 1969)

$$SE\left(\frac{x}{y}\right) = 4\sqrt{\frac{p0}{n}}$$

The analysis shows that it has been delining gradually over the period and its value has come down from 1.37 in 1973 to 1.15 in 1984

Influence of Maternal Age on Sex Ratio at Birth

C.2 The relationship between sex ratio at birth and maternal age is first studied through regression analysis for applying linear as well as quadratic models.

Linear Model : $y = b_0 + b_1 x$

Quadratic Model : $y = b_0' + b_1' x + b_2' x^2$

Where y = Proportion male births

X = maternal age

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* See Appendix

The results of the analysis are shown in Table 4 . It may be seen that more than 30 percent of variation in sex ratio at birth is explained by maternal age for the years 1974, 1975 and 1976 through the linear model as compared to the years 1974, 1975, 1976, 1981 and 1982 through the quadratic model. For other years the explained variation is below 15 percent under the linear model and below 20 percent under the quadratic model. The analysis of the results also points out that the quadratic model explains larger variation compared to the linear model for each year suggesting thereby that the relationship between sex ratio at birth and maternal age in non-linear.

Influence of Birth order and Maternal Age on Sex Ratio at Birth

C.3 Sex Ratio at birth was futher investigated by considering two variables, maternal age and birth order simultaneously. For this purpose, data on kuwaiti births by maternal age, birth order and sex of the infant for the years 1975 to 1983 formed the basis. The following quadratic model suggested by Novitski and Kimball (1958) was applied to the regression analysis.

$$p_{ij} = b_0 + b_1 (BO)_i + b_2 (MA)_j + b_{11} (BO)_j^2 + b_{22} (MA)_i^2 + b_{12} (BO)_i (MA)_j$$

Where p_{ij} = Sex ratio in ith birth birth order and jth maternal age category.

MA = Maternal age

BO = Birth order

The results are presented in the Table 5.

It is observed that R^2 values are much lower here than those obtained under the quadratic model of Meternal age alone. This indicates that among the three model studied here, the quadratic model of Maternal age provides a better fit among them.

C.4 Conclusively it may be stated that the analysis shows that the sex ratio at birth has fluctuated between 101 and 105 during the period 1973-84 and no declining trend is observed. So the sex ratio at birth does not explain the declining trend in sex ratio in kuwaiti population.

D- Sex Differentials in Mortality

D.1 Kuwaiti Deaths and Death rates during the years 1975-1984 are shown in Table 6. As may be seen, the mortality among males as depicted by death rates was always higher compared to females.

D.2 Let us assume that kuwaiti females had the same mortality level as kuwaiti males during the period (1975-84). Then there would have occurred more female deaths that what actually happened. The total number of female deaths during 1975-84 were 11936 out of which 6274 had accurred during (1975-79) and 5662 during 1980-84. Against these, the expected deaths woul have been 16564 that is, 8396 during (1975-79) and 8168 during (1980-48). These expected more deaths among kuwaiti females would have resulted in lowering their population counts in 1980 and 1985 to the same extent and thereby increasing the sex ratios in these years. The expected sex ratios would, then, have been 99.2 in 1980 and 99.9 in 1985 as against 98.5 in these years. This excercise clearly shows the extent to which differential in mortality among kuwaiti males and females has contributed in lowering the sex ratio.

E- Mixed Marriages

E.1 Data on mixed marriages among kuwaiti population during the years 1974-1982 are presented in Table 7 . There were 2918 marriages between kuwaiti men and Non-Kuwaiti women during the inter-censal period (1975-80) as against 974 marriages between kuwaiti women and Non-Kuwaiti men. Thus the net inflow of women into Kuwaiti society was 1944 was 1944 women. kuwait being a traditional Muslim Country,

there exists a possibility that in the census counts, the nationalities of the women of mixed marriages were not probed by the investigators and the nationalities of their husbands were recorded against them. If this were the case, then this alone would have resulted in pushing up the sex ratio to 99.2 in 1980 against 98.5 Further the combined effect of two factors - mixed marriages and mortality differential - would have been to raise the sex ratio to 99.9 in 1980.

E.2 The census data shows that the sex ratio has gone down from 100.5 in 1975 to 98.5 in 1980. Of this observed decline in sex ratio, this analysis shows that perhaps 70 percent was due to morality differential and error in recording the nationality of women of mixed marriages during the census counts.

4. Conclusion

Sex Ratio in Kuwaiti Population has been declining since 1961. This has been demostrated by the census data. It has come down from 109.1 in 1961 to 98.5 in 1985. Various factors which influence the change in Sex ratio has been considered. Census counts, especially of later years, are considered to be fairly correct though there were no Post Enumation surveys. There however exists the possibility of error in the nationality of the respondents - Non Kuwaitis declaring as kuwaitis - but if this has happened for the families as a whole, their effect on sex ratio would be neglegible. Regarding migration, there is very little attraction for a Kuwaiti national migrating permanently to another country because of their high standard of living in their own country and their cultural background. Another factor which influences the sex ratio is the sex ratio at birth. The analysis shows there was no trend over the past years and the sex ratio at birth rather oscillated between 101 and 105. Regarding mortality differential and mixed marriages, it is found that kuwaiti females have lower mortality than kuwaiti males and there were more kuwaiti men marrying Non-Kuwaiti women than Non-Kuwaiti men marrying kuwaiti women.

Aalysis of the data for the inter-censal (1975-80) Period has shown that 70 percent of the decline in sex ratio could be due to mortality differential and error in recording the nationality of women mixed marriages at the time of census.

Table -1-

Census Date by sex, Kuwaiti Population 1957-1985

Census	Males	Famales	Tatal	Excess of males over Females	Sex Ratio
1957	59154	54468	113622	4686	108.60
1961	84461	77448	161909	7013	109.06
1965	112569	107490	220059	5079	104.73
1970	175513	171883	347396	3630	102.11
1975	236600	235488	472088	1112	100.47
1980	280649	284964	565613	(-)4315	98.49
1985*	337243	342358	679601	(-)5115	98.51

*Provisional data for 1985 census.

Source : Monthly Digest of Statistics, Central Statistical Office, Ministry of Planning, Kuwait - April 1985.

Table 2
Excess of Males Over Females and
Sex Ratios by Age, Census rears,
"Kuwaiti Population"

Age	Excess of Males Over Femals				Sex Ratio			
Group	1965	1970	1975	1980	1965	1970	1975	1980
0	346	218	206	421	108.3	103.7	102.2	103.9
1-4	306	48	1138	1108	101.7	100.2	103.2	102.6
5-14	1670	2413	1356	1453	105.4	104.7	101.9	101.7
15-19	(-) 979	(-) 1633	(-) 1844	(-) 3872	90.8	90.9	92.7	93.3
20-29	(-) 91	(-) 2388	(-) 3687	(-) 5638	99.5	91.4	90.7	85.3
30-39	1953	2093	829	218	118.9	112.5	103.5	99.1
40-44	1648	2384	2238	1734	126.5	125.8	116.5	112.9
50+	226	525	876	697	102.3	103.7	105.0	104.8

Source : 1. Monthly Digest of Statistics, Central Office, Ministry of Planning, Kuwait, April, 1985.

2. Annual Statistical Abstracts, Central Statistical Office, Ministry of Planning, Kuwait, 1976-1984.

Table 3

Sex Ratio at Birth and its Standard Error

Kuwaiti Births, 1973-1984

Year	Male Births	Females Births	Sex Ratio	S.E.
1973	10875	10464	103.92	1.37
1974	11406	11307	100.88	1.33
1975	12395	11946	103.76	1.28
1976	12720	12215	104.13	1.27
1977	12519	12271	102.02	1.27
1978	12785	12343	103.58	1.26
11979	13054	12445	104.89	1.25
1980	13756	13212	104.12	1.22
1981	14132	13866	101.92	1.20
1982	14801	14203	104.21	1.17
1983	14873	14640	101.59	1.16
1984	15451	14997	103.03	1.15

Source : Annual Reports - Vital and Health Statistics Division, Ministry of Public Health, Kuwait.

Table 4

Regression Analysis of The Effect of Maternal Age on Sex Ratio With Linear and Quadratic Models, Models, Kuwaiti Population 1973 - 1982

Year	Regression Coefficients With Linear Model		R^2 (Percent)	Regression Coefficients With Quadratic Model			R^2 (Percent)
	b_0	b_1		b'_0	b'_1	b'_2	
1973	.5202	-.00058	6.89	.5435	-.0022	.000025	7.69
1974	.5172	-.00055	30.98	.4953	.0009	.000023	34.85
1975	.5476	-.00137	35.28	.4421	.0058	-.000110	51.95
1976	.4534	.00219	62.19	.6198	-.0091	.000174	91.58
1977	.4989	.00026	3.95	.4733	.0020	-.000027	7.02
1978	.5429	-.00087	10.95	.5822	-.0043	-.000053	14.00
1979	.5252	-.00047	6.14	.4474	.0048	-.000081	19.16
1980	.4993	.00035	5.16	.5447	.0027	.000047	12.37
1981	.4942	.00048	6.01	.6625	.0110	.000176	66.30
1982	.5346	-.00093	13.37	.3663	.0105	-.000176	49.57

Table 5

Multiple Regression Analysis of the Effect of Birth order and Maternal Age on Sex Ratio With a Quadratic Model, Kuwaiti Population; 1975-1983

Year	R^2	b_0	b_1	b_2	b_{11}	b_{22}	b_{12}
1975	6.06	.513954	.002594	-.011153	.000177	.002426	-.001345
1976	16.10	.520052	-.001103	-.009686	-.000227	.001786	.000811
1977	7.87	.515025	-.002308	-.005020	.000505	.001562	-.000837
1978	9.66	.530131	-.002696	-.012029	.000524	.002448	-.001227
1979	9.62	.487442	-.000595	.008401	.000456	-.000538	-.000719
1980	7.58	.495753	-.002191	.011929	.000786	-.000997	-.001488
1981	14.24	.541209	-.010900	-.011314	.000814	.001172	.000514
1982	7.00	.504067	.001322	.002328	.000159	-.000235	-.000501
1983	7.67	.502227	-.001185	-.000765	.000981	.002486	-.002668

Table 6

Deaths and Death Rates By sex

Kuwaiti Population, 1975-1984

Year	Deaths		Death Rate (Per 1000 Pop.)	
	M	F	M	F
1975	1635	1282	6.9	5.4
1976	1568	1189	6.4	4.8
1977	1796	1354	7.0	5.3
1978	1669	1199	6.3	4.5
1979	1693	1250	6.2	4.5
1980	1684	1229	6.0	4.3
1981	1534	1155	5.2	3.9
1982	1705	1123	5.6	3.6
1983	1588	1018	5.1	3.4
1984	1465	1074	4.5	3.2

Notes 1. The source of death statistics are the Annual Reports, Vital and Health Statistics Division, Ministry of Public Health, Kuwait,

2. Death rates are calculated by using the Population estimates Prepared by CSO, Kuwait.

Table 7

Mixex Marriages, Kuwaiti Populatio n
1974-1984

Year	Kuwaiti Women & NK Men	Kuwaiti Men & NK Women
1974	99	378
1975	113	451
1976	131	543
1977	197	594
1978	252	662
1979	281	668
1980	333	713
1981	379	639
1982	441	742

Source : Annual Statistical Abstracts - CSo, Kuwait.

Appendix*

Let x = Number of male births

y = Number of female births

Then $x + y = n$ (Total births)

So, $p_{xy} = -1$

Let $P = \frac{x}{x+y} = \frac{x}{n}$ = Proportion of male births

$Q = \frac{y}{x+y} = \frac{y}{n}$ = Proportion of female births

Now Var (x) = nPQ = var (y)

and Cov (xy) = $\sqrt{\text{Var (x) Var (y)}} = -nPQ$

Now

$$\frac{x}{y} = \frac{(x-y) - (x-y)}{(x-y) - (x-y)} = \frac{1 + [(x-y)/(x+y)]}{1 - [(x-y)/(x+y)]}$$

$$= \left(1 + \frac{x-y}{x+y}\right)\left(1 + \frac{x-y}{x+y} + \ldots\ldots\ldots\right)$$

$$= 1 + 2\left(\frac{x-y}{x+y}\right) = 1 + 2\left(\frac{x}{n} - \frac{y}{n}\right),$$

omiting higher powers of $\left(\frac{x-y}{x+y}\right)$

So, Var $\left(\frac{x}{y}\right)$ = 4 Var $\left(\frac{x}{n} - \frac{y}{n}\right) = \frac{4}{n^2}$ [Var (x) + Var (y) -2 Cov(xy)]

$$= 16\frac{PQ}{n}$$

and S.E $\left(\frac{x}{y}\right) = 4\sqrt{\left(\frac{PQ}{n}\right)}$

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