

UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER 2005

TITLE OF PAPER: INDIRECT TECHNIQUES OF DEMOGRAPHIC ESTIMATION

COURSE CODE : DEM 303

TIME ALLOWED : THREE (3) HOURS

INSTRUCTIONS : ANSWER ALL QUESTIONS FROM SECTION A AND ANY THREE (3) QUESTIONS FROM SECTION B.

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SECTION A: ANSWER ALL QUESTIONS (40 MARKS)

QUESTION 1 (8+8+4 marks)

- a. What is meant by model life table? Describe any three uses of model life tables.
- b. Point out two (2) similarities and two (2) differences between the Coale-Demeny model life tables and the United Nations model life tables for developing countries.
- c. Specify the family of the life tables that would best represent the mortality pattern in the following populations:
 - i. A population with high malnutrition among infants and children.
 - ii. A population with high incidence of neonatal tetanus.
 - iii. A population with high mortality during infancy and childhood years and young adult years.
 - iv. A population with high male death rate at older ages in relation to their death rates at younger ages.

QUESTION 2 (4+16 marks)

- a. What are the assumptions of the P/F ratio method for estimating fertility based on children ever born?
- b. In the 1973 Sudanese census, data was obtained on children ever born and births in the last 12 months. Based on these results, attempt was made to estimate the total fertility rate (TFR) using the Trussel variant of Brass P/F ratio method (Manual X method). The results are shown in Tables 1 and 2 below using standard symbols.
 - i. Fill in the blanks in the tables
 - ii. Estimate the adjusted TFR for Sudan.

NB. Please refer to the attached Appendix for the relevant formulae and coefficients.

Table 1.

| i | ASFR | $\phi(i)$ | Parity | F(i) | P(i)/F(i) |
|---|--------|-----------|--------|--------|-----------|
| 1 | 0.1061 | 0.5304 | 0.369 | 0.234 | ----- |
| 2 | 0.2496 | 1.7784 | 1.792 | ----- | 1.43 |
| 3 | 0.2567 | ----- | 3.283 | 2.5673 | 1.28 |
| 4 | 0.1986 | 4.0549 | 4.358 | 3.650 | 1.19 |
| 5 | 0.1425 | 4.7674 | 5.01 | 4.5173 | 1.11 |
| 6 | 0.0551 | ----- | 4.943 | ----- | 1.01 |
| 7 | 0.0312 | 5.1989 | 4.854 | 5.1622 | 0.94 |

Table 2

| i | w(i) | 1-w(i) | f+(i) | f*(i) |
|---|--------|--------|-------|-------|
| 1 | 0.083 | 1.00 | 0.127 | 0.165 |
| 2 | 0.1045 | 0.9170 | 0.256 | 0.333 |
| 3 | 0.1168 | 0.8955 | 0.253 | ----- |
| 4 | 0.1215 | 0.8832 | 0.193 | 0.251 |
| 5 | 0.1716 | 0.8785 | ----- | 0.176 |
| 6 | ----- | 0.8284 | 0.051 | 0.066 |
| 7 | | 0.8224 | 0.026 | 0.034 |

SECTION B: ANSWER ANY THREE (3) QUESTIONS**(60 MARKS)****QUESTION 3**

- a. What are the assumptions of the Brass method for estimating childhood mortality using information from women on proportion of children dead?
- b. You are given below data on average parity per woman and proportion of children dead classified by age of women.

| Age Group | i | Average Parity | Proportion Dead |
|-----------|---|----------------|-----------------|
| 15-19 | 1 | 0.156 | 0.0959 |
| 20-24 | 2 | 1.326 | 0.1218 |
| 25-29 | 3 | 2.765 | 0.1485 |

Using Trussel's variant of the Brass Method (Manual X), calculate $q(2)$ and $q(3)$ and the reference period.

You may find the following information useful:

Coefficients for estimation of multipliers

| i | a(i) | b(i) | c(i) |
|---|--------|---------|---------|
| 1 | 1.0819 | -3.0005 | 0.8689 |
| 2 | 1.2846 | -0.6181 | -0.3024 |
| 3 | 1.2223 | 0.0851 | -0.4704 |

Coefficients for the estimation of the reference period:

| i | a(i) | b(i) | c(i) |
|---|--------|--------|--------|
| 1 | 1.0900 | 5.4443 | -1.972 |
| 2 | 1.3079 | 5.5568 | 0.2021 |
| 3 | 1.5173 | 2.6755 | 4.7471 |

QUESTION 4 (6+6+4+4 marks)

- a. Without performing any mathematical derivation, show the formulas (with explanations) that can be used to estimate the following parameters of a stable population:
- i. intrinsic birth rate;
 - ii. proportion of stable population at age $x - C(x)$
 - iii. intrinsic rate of growth.
- b. What are the assumptions of the Coale and Trussel marital fertility model? Explain the meanings of the parameters of the model.
- c. Give any four uses of the Brass Logit model.
- d. What is the difference between a stable population and a quasi-stable population?

QUESTION 5 (10+10 marks)

Describe in detail the following methods:

- a. Reverse survival technique;
- b. Preceding birth technique.

Note: Make sure to describe the assumptions, data requirements, computational procedure, resulting estimates, and limitations.

QUESTION 6 (6+6+8 marks)

- a. State the assumptions of the widowhood method.
- b. What are the advantages of the widowhood method over the orphanhood method?
- c. Using the data on the proportions of ever-married respondents classified by age given below, calculate the male probability of survival from age 20 to age 35, and from age 20 to 40:

| Age | $NW_f(n)$ | $NW_f(n-5)$ |
|-----|-----------|-------------|
| 30 | 0.9514 | 0.9729 |
| 35 | 0.9170 | 0.9514 |
| 40 | 0.8735 | 0.9170 |

You may find the following information useful:

$$l_f(n)/l_m(20) = a(n) + b(n) \text{ SMAM}_f + c(n) \text{ SMAM}_m + d(n) \text{ NW}_f(n-5)$$

where $a(n)$, $b(n)$, $c(n)$, $d(n)$ have the following values:

| n | a(n) | b(n) | c(n) | d(n) |
|----|---------|----------|---------|--------|
| 30 | -0.0284 | -0.00465 | 0.00157 | 1.0822 |
| 35 | -0.0159 | -0.00638 | 0.00253 | 1.0831 |
| 40 | -0.0041 | -0.00784 | 0.00395 | 1.0596 |

Assume that $\text{SMAM}_m = 25.3$ years and $\text{SMAM}_f = 23.2$ years.

QUESTION 7 (11+9 marks)

- a. With regard to the orphanhood method for estimating adult mortality, state the following: the assumptions, principle and limitations.
- b. You are given the data below on proportion of females whose mothers were alive at the time of interview, classified by five year age group.

| Age Group | Proportion with Mother alive, S(n) |
|-----------|------------------------------------|
| 15-19 | 0.9283 |
| 20-24 | 0.8639 |
| 25-29 | 0.7911 |

Using Hill and Trussel variant of the orphanhood method, calculate $l(45)/l(25)$, $l(50)/l(25)$ and $l(50)/l(45)$ assuming the mean age at maternity is 30.0 years.

You may find the following information useful:

$$l(25+n)/l(25) = a(n) + b(n) * M + c(25) * S(15), \text{ where}$$

| n | a(n) | b(n) | c(n) |
|----|---------|---------|--------|
| 20 | -0.1798 | 0.00476 | 1.0505 |
| 25 | -0.2267 | 0.00737 | 1.0291 |
| 30 | -0.3108 | 0.01072 | 1.0287 |

APPENDIX

TABLE OF COEFFICIENTS

$$F(i) = \phi(i-1) + a(i)f(i) + b(i)f(i+1) + c(i)\phi(7) \quad (1)$$

Where $a(i)$, $b(i)$ and $c(i)$ have the following values:

| Age group | i | a(i) | b(i) | c(i) |
|--------------|---|-------|--------------------|---------|
| 15-19 | 1 | 2.351 | -0.188 | 0.0024 |
| 20-24 | 2 | 3.321 | -0.754 | 0.0161 |
| 25-29 | 3 | 3.265 | -0.627 | 0.0145 |
| 30-34 | 4 | 3.442 | -0.563 | 0.0029 |
| 35-39 | 5 | 3.518 | -0.763 | -0.0006 |
| 40-44 | 6 | 3.862 | -2.481 | -0.0001 |
| 45-49 | 7 | 3.828 | 0.016 ^a | -0.0002 |

^a This coefficient should be applied to $f(6)$ instead of $f(8)$

$$w(i) = x(i) + \frac{y(i)f(i)}{\phi(7)} + \frac{z(i)f(i+1)}{\phi(7)} \quad (2)$$

Where $x(i)$, $y(i)$ and $z(i)$ have the following values:

| Age group | i | x(i) | y(i) | z(i) |
|--------------|---|-------|-------|---------|
| 15-19 | 1 | 0.031 | 2.287 | 0.114 |
| 20-24 | 2 | 0.068 | 0.999 | -0.233 |
| 25-29 | 3 | 0.094 | 1.219 | -0.977 |
| 30-34 | 4 | 0.120 | 1.139 | -1.531 |
| 35-39 | 5 | 0.162 | 1.739 | -3.592 |
| 40-44 | 6 | 0.270 | 3.454 | -21.497 |

$$f^+(i) = (1 - w(i-1))f(i) + w(i)f(i+1) \quad (3)$$